

October 24, 2000

27-19071.001



Mr. Donald Webster
USEPA Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960

RE: Revised Quality Assurance Project Plan (QAPP) for the
Interim Measures Additional Sampling and Equalization Lagoon
Closure Monitoring
Grenada Manufacturing, LLC, Grenada, Mississippi

Dear Mr. Webster:

On behalf of Arvin Meritor, Inc., Brown and Caldwell is submitting two copies of the revised QAPP for the referenced site. Two copies have also been sent to Mr. Louis Crawford at the Mississippi Department of Environmental Quality. The QAPP received conditional approval from the USEPA in a letter dated October 6, 2000. The conditional approval specified the following comments, which have been addressed in the enclosed revised QAPP. The following presents comments and associated responses.

1. Section 4.0 – This section detailing the project organization does not identify a Quality Assurance Officer. Moreover, quality assurance responsibilities are apparently not assigned to either an individual or organization involved in this project. This critical omission should be corrected.

Response: Ronald A. Burt, Ph.D. has been designated as the Quality Assurance Officer for the RCRA corrective action activities (see Figure 4-1 in Section 4.0). Carol Bullock has been designated as the Quality Assurance Officer for the Equalization Lagoon Closure Sampling.

2. Tables 6.2, 12-1, - In order to be complete, these tables on the analytical methodology should include the extraction and clean-up methods. In addition, the source of the methods should be referenced.

Response: Table 6-2 has been revised accordingly (see Section 6.0). A reference was added to Table 12-1 that references Table 6-2.

3. Section 7.0 – This section on data quality objectives (DQO) does not present any evidence or documentation that the DQO process was followed. The DQO process should be followed and documentation presented in the document to demonstrate that the process was followed. It is recommended

that the EPA document "Guidance for the DQO Process", EPA QA/G-4, be followed.

Response: Section 7.0 has been revised in accordance with "Guidance for the DQO Process" (EPA QA/G-4) to provide documentation of the DQO process.

4. Section 15.1.1 – This section references analytical data validation guidelines from Region 1. However, the subject site is located in Region 4 and the use of these guidelines is not appropriate. Data validation guidance documents appropriate to Region 4 should be referenced. Such references would include "Data Validation SOP for CLP Routine Analytical Services" and the inorganic and organic National Functional Guidelines.

Response: Based on the data quality objectives set-forth for the project, third party validation is not intended for the project. Section 15.1.1 has been revised to reflect the level of internal validation that will be employed for this project.

The follow presents the flagged QAPP elements for the EPA QAPP check list and associated response:

- A1. Dated signature of quality assurance officer.

Response: Dated signature locations were added to the title page for the Quality Assurance Officers.

- A8. Special training requirements/certifications.

Response: Special training certification requirements are presented in Section 20.0.

- A9. and B4. State requested laboratory turnaround time.

Response: A laboratory turnaround time of 25 business days was added to Section 7.4, Section 12.0, and Section 14.0.

- B5. Reference procedures used to calculate QC statistics including precision and accuracy.

Response: Procedures for calculating the QC statistics are presented in Section 7.4.

Mr. Donald Webster
October 24, 2000
Page 3

C2. Project Status.

Response: Section 14.0 was modified to include a project status task by project manager.

Please provide any additional comments regarding this revised QAPP to Mr. Don Williams at Grenada Manufacturing. If you should have any questions, please feel free to call me at (615) 255-2288 or contact me by e-mail at dshowers@brwnald.com.

Sincerely,

BROWN AND CALDWELL



Dale R. Showers, P.E.
Project Manager
Design & Solid Waste

cc: Louis Crawford, P.E., MDEQ
John Bozick, Meritor Automotive
Don Williams, Grenada Manufacturing
John Kandler, Textron

August 25, 2000

27-19071.001



Mr. Don Webster
USEPA Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960

RE: Quality Assurance Project Plan (QAPP)
Interim Measures Additional Sampling and Equalization Lagoon
Closure Monitoring
Grenada Manufacturing, LLC
Grenada, Mississippi

Dear Mr. Webster:

On behalf of Arvin Meritor, Inc., Brown and Caldwell is submitting two copies of the draft QAPP for the referenced site. Two copies have also been sent to Mr. Louis Crawford at the Mississippi Department of Environmental Quality.

Please provide your comments regarding this QAPP to Mr. Don Williams at Grenada Manufacturing. If you should have any questions, please feel free to call me at (615) 255-2288 or contact me by e-mail at dshowers@brwnncald.com.

Sincerely,

BROWN AND CALDWELL

Dale R. Showers, P.E.
Project Manager
Design & Solid Waste

cc: Louis Crawford, P.E., MDEQ
John Bozick, Arvin Meritor
Don Williams, Grenada Manufacturing
John Kandler, Textron
Caleb Dana, ECO-Systems, Inc

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KCRA PROGRAMS BRANCH

November 17, 2000

27-19071.001



Mr. Donald Webster
USEPA Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960

RE: Revised Quality Assurance Project Plan (QAPP) for the Interim Measures
Additional Sampling and Equalization Lagoon Closure Monitoring
Grenada Manufacturing, LLC, Grenada, Mississippi

Dear Mr. Webster:

On behalf of Arvin Meritor, Inc., Brown and Caldwell is submitting the enclosed change pages for the referenced Quality Assurance Project Plan (QAPP). Copies have also been sent to Mr. Louis Crawford at the Mississippi Department of Environmental Quality (MDEQ). The QAPP received conditional approval from the USEPA in a letter dated October 6, 2000. The conditional approval included comments, which were addressed in a revised QAPP transmitted to USEPA and MDEQ on October 24, 2000. Additional comments were discussed with you by telephone on November 14, 2000. These comments are addressed by the enclosed change pages.

The following revisions were made and are presented on the attached pages:

- Maximum Contaminant Levels (MCLs) presented in Table 6-2 are included only for the constituents of concern for the site. A footnote has been added to Table 6-2 and text on page 6-2 has been added to make this clarification.
- On page 7-4, the last sentence in the bullet describing conformational data quality objectives (DQO; Level 4) was deleted as it conflicted with the last sentence on the page. The selected DQO for this project is Level 4. However, as we discussed and agreed to on November 14, there are no current plans to perform third party validation of the analytical data.

It is our understanding that you will issue an approval letter for this revised version of the QAPP if the revisions reflected on these change pages adequately address your additional comments. We look forward to receiving such an approval. Please provide any additional comments you may have regarding this revised QAPP to

Mr. Donald Webster
November 17, 2000
Page 2

Mr. Don Williams at Grenada Manufacturing. If you should have any questions, please feel free to contact me at your convenience.

Sincerely,

BROWN AND CALDWELL



Dale R. Showers, P.E.
Project Manager
Design & Solid Waste

cc: Louis Crawford, P.E., MDEQ
John Bozick, Meritor Automotive
Don Williams, Grenada Manufacturing
John Kandler, Textron

shallow and intermediate wells at the site. Table 6-2 presents the list of laboratory parameters to be analyzed. The available maximum contaminant levels (MCLs) only for the site constituents of concern are presented in Table 6-2. The methods and procedures that will be followed to conduct the groundwater sampling are presented in Section 9.0.

6.3 Equalization Lagoon Closure Sampling Task

Existing monitoring wells MWRT-1, MWRT-2, MWRT-4 and MWRT-5 will be used as sampling locations for the requirements of this monitoring program. These represent locations downgradient of the closed lagoon where potential impacts would be first detected.

Samples will be collected quarterly from each of the four listed wells for the first year of the project. The sampling frequency will drop to twice yearly for the four wells for the second through thirtieth years. Samples will be collected and analyzed for VOCs and TAL metals. Table 6-2 presents the list of laboratory parameters to be analyzed. The available maximum contaminant levels (MCLs) only for the site constituents of concern are presented in Table 6-2. The required methods and procedures to conduct the groundwater sampling are presented in Section 9.0.

Table 6-1 Interim Measures Work Plan – Monitoring Well Network

Well Name
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-17
MW-20
MW-23
MW-24
MW-25
MWRT-1
MWRT-2
MWRT-3
MWRT-4
MWRT-5

Table 6-2 Parameters to be Measured

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^b (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Aluminum	7429-90-5	3005A	6010B	NA		NA	50	12	
Antimony	7440-36-0	3005A	6010B	NA		NA	10	5.0	
Arsenic^a	7440-38-2	3005A	6010B	NA	50	NA	5.0	3.0	X
Barium	7440-39-3	3005A	6010B	NA	2,000	NA	5.0	1.0	X
Beryllium	7440-41-7	3005A	6010B	NA		NA	5.0	0.20	
Cadmium	7440-43-9	3005A	6010B	NA	5	NA	1.0	0.30	X
Calcium	7440-70-2	3005A	6010B	NA		NA	1000	100	
Chromium (total)^a	7440-47-3	3005A	6010B	NA	100	NA	5.0	1.0	X
Cobalt	7440-48-4	3005A	6010B	NA		NA	5.0	1.0	
Copper	7440-50-8	3005A	6010B	NA		NA	5.0	2.0	
Iron	7439-89-6	3005A	6010B	NA		NA	50	20	
Lead	7439-92-1	3005A	6010B	NA	15	NA	5.0	2.0	X
Magnesium	7439-95-4	3005A	6010B	NA		NA	1000	100	
Manganese	7439-96-5	3005A	6010B	NA		NA	5.0	1.0	
Mercury	7439-97-6	7470A	6010B	NA	2	NA	0.20	0.10	X
Nickel	7440-02-0	3005A	6010B	NA		NA	5.0	1.0	
Potassium	7440-09-7	3005A	6010B	NA		NA	1000	100	
Selenium	7782-49-2	3005A	6010B	NA	50	NA	5.0	2.0	X
Silver	7440-22-4	3005A	6010B	NA		NA	1.0	0.20	X
Sodium	7440-23-5	3005A	6010B	NA		NA	1000	100	
Thallium	7440-28-0	3005A	6010B	NA		NA	5.0	1.0	
Vanadium	07440-62-2	3005A	6010B	NA		NA	5.0	1.0	
Zinc	7440-66-6	3005A	6010B	NA		NA	10	1.0	
Chromium (hexavalent)^a	7440-47-3	Modified 7196A	6010B	NA		NA	25	5.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^p (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Chloromethane	74-87-3	5030B	8260B	NA		5.0	5.0	2.0	X
Bromomethane	74-83-9	5030B	8260B	NA		5.0	5.0	3.0	
Vinyl Chloride^a	75-01-4	5030B	8260B	NA	2	5.0	5.0	2.0	X
Chloroethane	75-00-3	5030B	8260B	NA		5.0	5.0	2.0	X
Methylene Chloride	75-09-2	5030B	8260B	NA		5.0	5.0	1.0	X
Acetone	67-64-1	5030B	8260B	NA		5.0	10	5.0	
Carbon Disulfide	75-15-0	5030B	8260B	NA		5.0	5.0	1.0	
1,1-Dichloroethene^a	75-35-4	5030B	8260B	NA	7	5.0	5.0	1.0	X
1,1-Dichloroethane	75-34-3	5030B	8260B	NA		5.0	5.0	2.0	X
cis-1,2-Dichloroethene^a	156-59-4	5030B	8260B	NA	70	5.0	5.0	1.0	X
trans-1,2-Dichloroethene	156-60-5	5030B	8260B	NA		5.0	5.0	1.0	
Chloroform	67-66-3	5030B	8260B	NA		5.0	5.0	1.0	X
1,2-Dichloroethane^a	107-06-2	5030B	8260B	NA	5	5.0	5.0	1.0	X
2-Butanone (Methyl Ethyl Ketone)	78-93-3	5030B	8260B	NA		5.0	15	10	X
1,1,1-Trichloroethane	71-55-6	5030B	8260C	NA		5.0	5.0	1.0	
Carbon Tetrachloride	56-23-5	5030B	8260C	NA		5.0	5.0	1.0	
Bromodichloromethane	75-27-4	5030B	8260C	NA		5.0	5.0	1.0	
1,2-Dichloropropane	78-87-5	5030B	8260C	NA		5.0	5.0	1.0	
cis-1,3-Dichloropropene	10061-01-5	5030B	8260C	NA		5.0	5.0	1.0	
Trichloroethene^a	79-01-6	5030B	8260C	NA	5	5.0	5.0	1.0	X
Dibromochloromethane	124-48-1	5030B	8260C	NA		5.0	5.0	1.0	
1,1,2-Trichloroethane^a	79-00-5	5030B	8260C	NA	5	5.0	5.0	1.0	
Benzene^a	71-43-2	5030B	8260C	NA	5	5.0	5.0	1.0	X
trans-1,3-Dichloropropene	10061-02-6	5030B	8260C	NA		5.0	5.0	1.0	
Bromoform	75-25-2	5030B	8260C	NA		5.0	5.0	1.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^b (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	108-10-1	5030B	8260C	NA		5.0	5.0	2.0	
2-Hexanone	591-78-6	5030B	8260C	NA		5.0	5.0	2.0	
Tetrachloroethene^a	127-18-4	5030B	8260C	NA	5	5.0	5.0	1.0	X
1,1,2,2-Tetrachloroethane	79-34-5	5030B	8260C	NA		5.0	5.0	1.0	X
Toluene^a	108-88-3	5030B	8260C	NA	1000	5.0	5.0	1.0	X
Chlorobenzene	108-90-7	5030B	8260C	NA	100	5.0	5.0	1.0	X
Ethylbenzene	100-41-4	5030B	8260C	NA	700	5.0	5.0	1.0	X
Styrene	100-42-5	5030B	8260C	NA	100	5.0	5.0	1.0	X
Xylenes (total)	1330-20-7	5030B	8260C	NA	10,000	5.0	5.0	1.0	X
(<i>m/p</i> -Xylenes)	108-38-3	5030B	8260C	NA		5.0	5.0	1.0	
(<i>o</i> -Xylenes)	95-47-6	5030B	8260C	NA		5.0	5.0	1.0	
Phenol	108-95-2	3510C	8270C	3640A		10	5.0	1.0	
bis(2-Chloroethyl)ether	111-44-4	3510C	8270C	3640A		10	5.0	2.0	
2-Chlorophenol	95-57-8	3510C	8270C	3640A		10	5.0	2.0	
1,3-Dichlorobenzene	541-73-1	3510C	8270C	3640A		10	5.0	2.0	
1,4-Dichlorobenzene	106-46-7	3510C	8270C	3640A		10	5.0	2.0	
1,2-Dichlorobenzene	95-50-1	3510C	8270C	3640A		10	5.0	2.0	
2-Methylphenol	95-48-7	3510C	8270C	3640A		10	5.0	2.0	
2,2-oxybis(1-Chloropropane)	108-60-1	3510C	8270C	3640A		10	5.0	2.0	
4-Methylphenol	106-44-5	3510C	8270C	3640A		10	5.0	4.0	
N-Nitroso-di-n-propylamine	621-64-7	3510C	8270C	3640A		10	5.0	2.0	
Hexachloroethane	67-72-1	3510C	8270C	3640A		10	5.0	1.0	
Nitrobenzene	98-95-3	3510C	8270C	3640A		10	5.0	1.0	
Isophorone	78-59-1	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^p (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
2-Nitrophenol	88-75-5	3510C	8270C	3640A		10	5.0	1.0	
2,4-Dimethylphenol	105-67-9	3510C	8270C	3640A		10	5.0	2.0	
bis(2-Chloroethoxy)methane	111-91-1	3510C	8270C	3640A		10	5.0	1.0	
2,4-Dichlorophenol	120-83-2	3510C	8270C	3640A		10	5.0	2.0	
1,2,4-Trichlorobenzene	120-82-1	3510C	8270C	3640A		10	5.0	2.0	
Naphthalene	91-20-3	3510C	8270C	3640A		10	5.0	2.0	
4-Chloroaniline	106-47-8	3510C	8270C	3640A		10	5.0	1.0	
Hexachlorobutadiene	87-68-3	3510C	8270C	3640A		10	5.0	2.0	
4-Chloro-3-methylphenol	59-50-7	3510C	8270C	3640A		10	5.0	2.0	
2-Methylnaphthalene	91-57-6	3510C	8270C	3640A		10	5.0	2.0	
Hexachlorocyclopentadiene	77-47-4	3510C	8270C	3640A		10	5.0	1.0	
2,4,6-Trichlorophenol	88-06-2	3510C	8270C	3640A		10	5.0	2.0	
2,4,5-Trichlorophenol	95-95-4	3510C	8270C	3640A		10	5.0	2.0	
2-Chloronaphthalene	91-58-7	3510C	8270C	3640A		10	5.0	2.0	
2-Nitroaniline	88-74-4	3510C	8270C	3640A		10	5.0	2.0	
Dimethylphthalate	131-11-3	3510C	8270C	3640A		10	5.0	1.0	
Acenaphthylene	208-96-8	3510C	8270C	3640A		10	5.0	2.0	
2,6-Dinitrotoluene	606-20-2	3510C	8270C	3640A		10	5.0	1.0	
3-Nitroaniline	99-09-2	3510C	8270C	3640A		10	10	2.0	
Semivolatile Organic Analytes (SW-846 8270C)									
Acenaphthene	83-32-9	3510C	8270C	3640A		10	5.0	2.0	
2,4-Dinitrophenol	51-28-5	3510C	8270C	3640A		10	10	7.0	
4-Nitrophenol	100-02-7	3510C	8270C	3640A		10	10	3.0	
Dibenzofuran	132-64-9	3510C	8270C	3640A		10	5.0	2.0	
2,4-Dinitrotoluene	121-14-2	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^p (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Diethylphthalate	84-66-2	3510C	8270C	3640A		10	5.0	1.0	
4-Chlorophenyl-phenylether	7005-72-3	3510C	8270C	3640A		10	5.0	2.0	
Fluorene	86-73-7	3510C	8270C	3640A		10	5.0	1.0	
4-Nitroaniline	100-01-6	3510C	8270C	3640A		10	10	2.0	
4,6-Dinitro-2-methylphenol	534-52-1	3510C	8270C	3640A		10	10	4.0	
N-Nitrosodiphenylamine ⁹	86-30-6	3510C	8270C	3640A		10	5.0	2.0	
4-Bromophenyl-phenylether	101-55-3	3510C	8270C	3640A		10	5.0	2.0	
Hexachlorobenzene (HCB)	118-74-1	3510C	8270C	3640A		10	5.0	2.0	
Pentachlorophenol	87-86-5	3510C	8270C	3640A		10	10	5.0	
Phenanthrene	85-01-8	3510C	8270C	3640A		10	5.0	2.0	
Anthracene	120-12-7	3510C	8270C	3640A		10	5.0	2.0	
Carbazole	86-74-8	3510C	8270C	3640A		10	5.0	2.0	
Di-n-butylphthalate	84-74-2	3510C	8270C	3640A		10	5.0	2.0	
Fluoranthene	206-44-0	3510C	8270C	3640A		10	5.0	2.0	
Pyrene	129-00-0	3510C	8270C	3640A		10	5.0	2.0	
Butylbenzylphthalate	85-68-7	3510C	8270C	3640A		10	5.0	2.0	
3,3'-Dichlorobenzidine	91-94-1	3510C	8270C	3640A		10	10	2.0	
Benzo(a)anthracene	56-55-3	3510C	8270C	3640A		10	5.0	2.0	
Chrysene	218-01-9	3510C	8270C	3640A		10	5.0	1.0	
bis(2-Ethylhexyl)phthalate ^a	117-81-7	3510C	8270C	3640A	6	10	5.0	2.0	
Di-n-octylphthalate	117-84-0	3510C	8270C	3640A		10	5.0	2.0	
Benzo(b)fluoranthene	205-99-2	3510C	8270C	3640A		10	5.0	2.0	
Benzo(k)fluoranthene	207-08-9	3510C	8270C	3640A		10	5.0	2.0	
Benzo(a)pyrene	50-32-8	3510C	8270C	3640A		10	5.0	2.0	
Indeno(1,2,3-cd)pyrene	193-39-5	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^b (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Dibenz(a,h)anthracene	53-70-3	3510C	8270C	3640A		10	5.0	2.0	
Benzo(g,h,i)perylene	191-24-2	3510C	8270C	3640A		10	5.0	2.0	

^a – RFI Constituent of Concern

^b – MCL for RFI Constituent of Concern and Equalization Lagoon Constituents of Concern based on National Primary Drinking Water Standards (EPA 810-F-94-001), December 1999.

NA = Not Applicable

Source: SW-846 Third Addition Final Up-date 3

- (d) *The null hypothesis (baseline condition) and the alternative hypothesis.* The baseline condition or null hypothesis (H) is "the parameter is of concern". The alternative hypothesis (H) is "the parameter is not of concern". The false positive decision error occurs when the null hypothesis is rejected when it is true. For this example, the false positive decision error occurs when the decision maker decides the parameter is not of concern when it truly is. The false negative decision error occurs when the null hypothesis is not rejected when it is false.

7.2 Data Quality Objectives

DQOs are qualitative and quantitative statements which specify the quality of the data required to support decisions made during closure activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to ARARs, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment at the site.
- Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. This level may include mobile laboratory or field gas chromatography generated data depending on the level of quality control exercised. There will be no DQO Level 2 samples collected.
- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile laboratory or field gas chromatography generated data and some analytical laboratory methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation).
- Conformational (DQO Level 4): This provides the highest level of data quality and is used, for example, for purposes of risk assessment. These analyses require data validation procedures in accordance with EPA recognized protocols, approved analytical methods and analytical detection limits.
- Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data. No sampling or analysis for this project will use DQO 5.

The selected data quality objective for this project is Level 4.

**Quality Assurance Project Plan (QAPP)
Interim Measures Additional
Sampling and Equalization Lagoon
Closure Monitoring**

prepared for

Arvin Meritor Inc.

November 2000

27-19071.001

**QUALITY ASSURANCE PROJECT PLAN (QAPP)
INTERIM MEASURES ADDITIONAL SAMPLING AND
EQUALIZATION LAGOON CLOSURE MONITORING**

Prepared for:

**Arvin Meritor Inc.
Troy, Michigan**

Prepared by:

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November 2000

19071.001

1.0 Title and Approval Page

Document Title: Quality Assurance Project Plan for the Interim Measures Additional Sampling and Equalization Lagoon Closure Monitoring

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Printed Name/Organization

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Signature/Date

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Dale R. Showers, Brown and Caldwell

Printed Name/Organization

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 2-1-01
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Eco•Systems, Inc.

Consultants, Engineers, and Scientists



February 1, 2001

Rec'd Feb. 9, 2001

Mr. Dale Showers
Project Manager
Brown and Caldwell
227 French Landing Drive
Nashville, TN 37228

Dear Mr. Showers:

Please find enclosed the final QAPP for Grenada Manufacturing. Caleb Dana and I have signed on page 1-1. However, I wanted to bring a change in *Eco•Systems* personnel to your attention. The organizational chart in Section 4.1 identifies Wade Steinriede as the Task Manager for *Eco•Systems*. However, the Task Manager is now Charles Coney.

Sincerely,

Carol Bullock
Staff Scientist

2.0 Table of Contents and Document Format

2.1 Table of Contents

1.0	Title and Approval Page	1-1
2.0	Table of Contents and Document Format.....	2-1
2.1	<i>Table of Contents</i>	<i>2-1</i>
2.2	<i>List of Tables</i>	<i>2-3</i>
2.3	<i>List of Figures</i>	<i>2-3</i>
3.0	Distribution List and Project Personnel Sign-off Sheet	3-1
4.0	Project Organization	4-1
5.0	Background Problem Definition	5-1
5.1	<i>Description of Current Site Status</i>	<i>5-1</i>
5.1.1	<i>Site Investigation and RCRA Corrective Action</i>	<i>5-1</i>
5.1.2	<i>Equalization Lagoon History/Background Information</i>	<i>5-2</i>
5.2	<i>Problem Definition</i>	<i>5-3</i>
5.2.1	<i>Additional Sampling for Interim Measures</i>	<i>5-3</i>
5.2.2	<i>Equalization Lagoon Closure Project Objectives and Scope</i>	<i>5-4</i>
6.0	Task Description and Schedule.....	6-1
6.1	<i>Interim Measures Direct Push Groundwater and Soil Sampling Task</i>	<i>6-1</i>
6.2	<i>Additional Interim Measures Groundwater Monitoring Task</i>	<i>6-1</i>
6.3	<i>Equalization Lagoon Closure Sampling Task.....</i>	<i>6-2</i>
6.4	<i>Field Quality Assurance/Quality Control Sampling.....</i>	<i>6-9</i>
6.5	<i>Project Schedule.....</i>	<i>6-11</i>
6.5.1	<i>Interim Measure Additional Sampling Schedule</i>	<i>6-11</i>
6.5.2	<i>Equalization Lagoon Closure Sampling</i>	<i>6-11</i>
7.0	Project Quality Objectives and Measurement Performance Criteria	7-1
7.1	<i>Data Quality Objective Process.....</i>	<i>7-1</i>
7.2	<i>Data Quality Objectives.....</i>	<i>7-4</i>
7.3	<i>Project Quality Objectives.....</i>	<i>7-5</i>
7.4	<i>Measurement Performance Criteria</i>	<i>7-5</i>
8.0	Inspection/Acceptance Requirements for Supplies and Consumables.....	8-1
9.0	Sampling Procedures and Requirements.....	9-1
9.0	<i>Groundwater Sampling</i>	<i>9-1</i>

9.1.1	Special Sampling Procedures for the Interim Measures Additional Sampling	9-4
9.2	<i>Direct-Push Sampling</i>	9-5
9.3	<i>Decontamination</i>	9-4
10.0	Sample Handling, Tracking and Custody Requirements	10-1
10.1	<i>Sample Collection Documentation</i>	10-1
10.2	<i>Sample Preservation, Container Specification, and Holding Time Requirements</i>	10-1
10.3	<i>Sample Chain-of-Custody</i>	10-2
10.4	<i>Laboratory Chain of Custody Procedures</i>	10-2
10.5	<i>Sample Archival</i>	10-3
11.0	Field Analytical Methods	11-1
12.0	Laboratory Analytical Method Requirements	12-1
12.1	<i>Laboratory Instruments</i>	12-1
12.2	<i>Laboratory Instrument Preventative Maintenance</i>	12-2
12.2.1	Inductively Coupled Plasma Spectroscopy	12-2
12.2.2	Gas Chromatograph Instruments	12-2
12.2.3	Atomic Absorption Instruments	12-3
12.2.4	Thermometers	12-3
12.2.5	Analytical Balances	12-3
12.3	<i>Inspection/Acceptance Requirements for Supplies and Consumables</i>	12-3
13.0	Quality Control Requirements	13-1
13.1	<i>Sampling Quality Control</i>	13-1
13.2	<i>Analytical Laboratory Quality Control</i>	13-2
14.0	Documentation, Records, and Data Management	14-1
14.1	<i>Project Documentation and Records</i>	14-1
14.2	<i>Laboratory Data Package Deliverables</i>	14-1
14.2.1	Hardcopy Data Package	14-1
14.3	<i>Data Tracking, Storage, and Control</i>	14-2
15.0	Assessments and Response Actions	15-1
15.1	<i>Planned Assessments</i>	15-1
15.1.1	Data Package technical Systems Audit	15-1
15.2	<i>Assessment Findings and Corrective Action Responses</i>	15-1
15.3	<i>Additional QAPP Non-Conformances</i>	15-2
15.3.1	Field Sampling	15-2
15.3.2	Laboratory Analysis	15-3
16.0	QA Management Reports	16-1

17.0	Verification and Validation Requirements	17-1
18.0	Verification and Validation Procedures	18-1
18.1	Data Validation	18-1
18.1.1	Procedures Used to Validate Field Data	18-1
18.1.2	Procedures Used to Validate Laboratory Data.....	18-1
18.2	Overall Assessment of Environmental Data.....	18-1
19.0	Data Usability/Reconciliation with Project Quality Objectives.....	19-1
20.0	Special Training Requirements/Certifications	20-1

2.2 List of Tables

Table 5-1	1992 - 1994 Data Summary - Organic Concentration Ranges.....	5-5
Table 5-2	1992 - 1994 Data Summary - Metal Concentration Ranges	5-5
Table 6-1	Interim Measures Work Plan - Monitoring Well Network.....	6-2
Table 6-2	Parameters to be Measured	6-3
Table 6-3	Field and Quality Control Sample Summary (per event).....	6-10
Table 7-1	Measurement Performance Criteria.....	7-8
Table 7-2	Analytical Laboratory Data Quality Objectives for Precision and Accuracy for Volatile Organic Compound Analyses	7-9
Table 7-3	Analytical Laboratory Data Quality Objectives for Semivolatile Organic Compound Precision and Accuracy	7-10
Table 7-4	Analytical Laboratory Data Quality Objectives for Precision and Accuracy for Inorganic Compound Analyses.....	7-11
Table 10-1	Sample Preservation, Container Specification, and Holding Time Requirements .	10-1
Table 12-1	Tests and Methods for the Groundwater Monitoring Program	12-1
Table 13-1	Field Sampling QC for VOC, SVOC, and TAL Metals	13-1
Table 13-2	Laboratory Sample QC Table for VOCs, SVOCs & Metals.....	13-2

2.3 List of Figures

Figure 4-1	Organizational Chart for Interim Measures Additional Sampling and Equalization Lagoon Closure Monitoring	4-1
Figure 6-1	Monitoring Well and Geoprobe Location Map.....	6-2
Figure 10-1	Example Sampling Data Sheet.....	10-2
Figure 10-2	Groundwater Sample Collection Report.....	10-3

Appendix A: Field Parameter Operation Manuals

3.0 Distribution List and Project Personnel Sign-off Sheet

The following is the distribution list for the QAPP.

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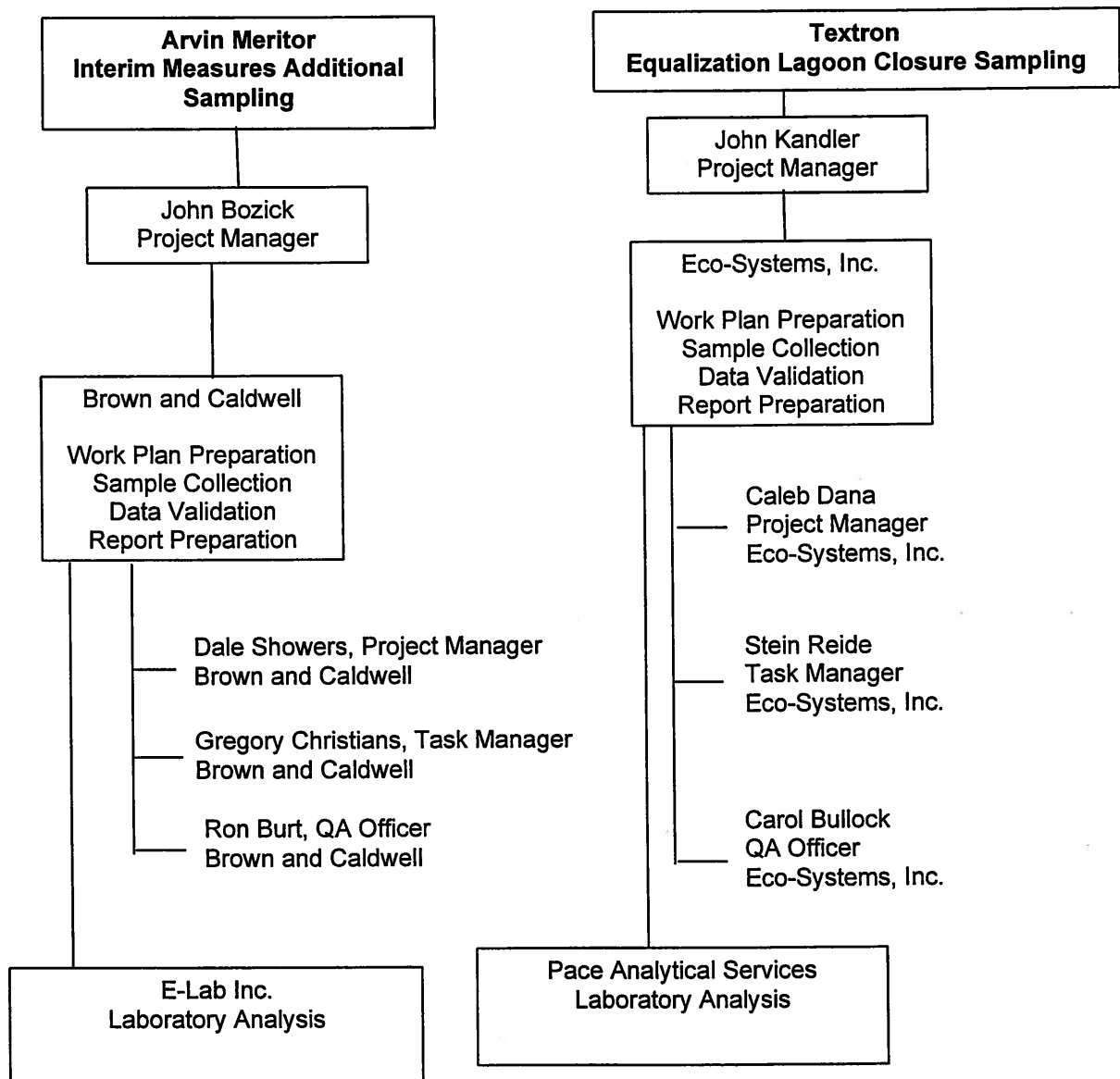
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4.0 Project Organization

The organizations and key individuals involved in the Interim Measures (IM) Additional Sampling and Equalization Lagoon Closure Sampling are set forth in the organizational chart below.

Figure 4-1 Organizational Chart for Interim Measures Additional Sampling and Equalization Lagoon Closure Monitoring



Laboratories:

The laboratories listed below have been selected for this IM Additional Sampling and Equalization Lagoon Closure Sampling. Laboratories will be subcontracted by Brown and Caldwell and Eco-Systems to provide analytical services.

Interim Measures Work Plan

E-Lab Inc.

Rick Davis – Laboratory Director

Peter Ciarleglio – Quality Assurance Officer

Equalization Lagoon Closure

Pace Analytical Services, Inc.

Jim Neulgan - Laboratory Manager

Gary Newton – Quality Assurance Officer

Responsibilities:**Arvin Meritor**

Arvin Meritor, as the primary party, has complete oversight of the project RCRA activities for the site.

Mr. John Bozick is the Project Manager. Mr. Bozick's duties are to ensure the overall satisfactory completion of the project. Mr. Bozick has complete authority over all actions taken at the site, including:

- Managing the development of the Work Plan.
- Contracting and management oversight of Work Plan Design, Reporting, Data Validation and Field Investigation activities.
- Obtaining approvals from local, state and federal authorities for all phases of work.
- Communicating with local, state and federal authorities on all matters relating to the project.
- Presenting the final report to authorities.

Textron

Textron has primary oversight responsibilities for the Equalization Lagoon Closure monitoring at the site.

Mr. John Kandler is the Environmental Coordinator and is the Project Manager for the Equalization Lagoon Closure monitoring. Mr. Kandler's duties are to ensure the overall satisfactory completion of the closure activities. Mr. Kandler has complete authority over all actions taken at the site relation to the Equalization Lagoon Closure, including:

- Managing the development of the Equalization Lagoon Closure monitoring.

- Contracting and management oversight of Work Plan Design, Reporting, Data Validation and Field Investigation activities.
- Obtaining approvals from local, state and federal authorities for all phases of work.
- Communicating with local, state and federal authorities on all matters relating to the project.
- Presenting the final report to authorities.

Brown and Caldwell (BC)

Brown and Caldwell's responsibilities relate only to RCRA Corrective Action activities for the site and include:

- Prepare draft, final draft, and final work plans.
- Secure analytical laboratories.
- Perform sample collection activities.
- Perform sample data validation.
- Prepare draft, final draft, and final reports.

ECO-Systems Inc.

ECO-Systems Inc. responsibilities relate only to the Equalization Closure monitoring activities and include:

- Prepare draft, final draft, and final work plans.
- Secure analytical laboratories.
- Perform sample collection activities.
- Perform sample data validation.
- Prepare draft, final draft, and final reports.

5.0 Background Problem Definition

This project is to (1) provide supplemental information for the evaluation and implementation of the RCRA Correction Action interim measures and (2) continue groundwater monitoring for the RCRA Equalization Lagoon Closure at the Grenada Manufacturing Site.

5.1 Description of Current Site Status

5.1.1 Site Investigation and RCRA Corrective Action

Rockwell Automotive North America, now Arvin Meritor, Inc. operated a wheel cover manufacturing facility in Grenada, Mississippi from 1966 to 1985 before selling the operations and property to Textron Automotive Company, formerly Randall Textron, who then sold the operations and property to Grenada Manufacturing, LLC in 1999. Grenada Manufacturing, LLC (Permittee) continues to operate the wheel cover plant. Arvin Meritor, Inc. and Textron Automotive Company have conducted a number of environmental investigations at the referenced facility. The most extensive investigative work is reported in the 1994 Remedial Investigation (RI) Report conducted by ECKENFELDER INC., now known as Brown and Caldwell (BC). The work was in response to an Mississippi Department of Environmental Quality (MDEQ) Administrative Order on Consent designed to investigate the on-site landfill, and was subsequently expanded to include other areas of the Site.

The RI conducted by ECKENFELDER INC. in January 1994 identified the presence of trichloroethylene (TCE) and its degradation products, as well toluene and chromium in the soil and groundwater at the Site. A Baseline Risk Assessment (BRA) was performed for soil and upper-site groundwater as part of the Supplemental RI report prepared by ECKENFELDER INC. in March 1994. The baseline risk assessment provides an evaluation of the potential threat to human health and the environment of the constituents of interest at the Site. The risk assessment identifies the constituents of interest and, through the exposure and toxicity assessments, characterizes the associated potential risk, assuming no action is taken at the Site. The primary concern with respect to impacted groundwater is the migration of chlorinated ethenes and ethanes to Riverdale Creek. Toluene and chromium are also of concern, but are present at much lower concentrations than are the chlorinated volatile organic compounds (VOCs) and do not threaten Riverdale Creek. The results of that investigation are discussed on a site-wide basis in the RI Report. The solid waste management units (SMWUs) and areas of concern (AOCs) had not yet been determined at the time the report was submitted to the MDEQ.

Subsequent to the submittal of the RI Report, the facility became subject to regulation under RCRA Corrective Action and a RCRA Facility Assessment (RFA) was performed by USEPA's contractor (A.T. Kearney, Inc., 1997) as part of the HSWA permit process for the facility in 1996 and 1997. As a result of the Preliminary Review (PR) and Visual Site Inspection (VSI), 26 SWMUs and 3 AOCs were identified.

On March 2, 1999, USEPA issued a combined RCRA Facility Investigation (RFI)/Confirmatory Sampling (CS) Work Plan call letter. Arvin Meritor and Textron requested a meeting at the Region IV office to review the results of the RI conducted for MDEQ and to identify potential data

gaps. During a meeting held on May 13, 1999 among the USEPA Region IV Project Manager, and representatives from Textron Automotive, Arvin Automotive, and BC, it was agreed that nearly all of the information that might be generated in an RFI/CS effort already existed. USEPA requested that summaries of data obtained subsequent to issuance of the 1994 RI Report be prepared and that the available data be organized by SWMU or AOC. That document, the Summary of Investigative Work (SOIW), was prepared by BC in response to that request and was transmitted to USEPA and MDEQ in July 1999.

A portion of the site's groundwater is currently impacted by TCE and its degradation products. Additionally, there is a portion of the Site where chromium impacts groundwater. Groundwater at the Site appears to discharge primarily to Riverdale Creek. Potential impact to the creek appears to be limited to TCE and its degradation products. Groundwater may also enter the outfall ditch, which discharges to Riverdale Creek. Impact to Riverdale Creek due to discharge of groundwater containing TCE and its degradation products has been identified as an environmental condition that could benefit from implementation of an Interim Remedial Measure.

5.1.2 Equalization Lagoon History/Background Information

Prior to its closure, the Equalization Lagoon measured approximately 525 feet long by 225 feet wide, with a depth of approximately 10 feet. The approximate capacity of the unit was 2,500,000 gallons. The Equalization Lagoon was constructed with seven influent pipes from the facility, and two effluent pipes in the basin. One effluent pipe discharged to the on-site wastewater treatment system while the other effluent pipe served as the overflow outfall line.

The Equalization Lagoon was designed to handle a maximum flow of 500,000 gallons per day. Actual flow averaged approximately 360,000 gallons per day. The majority (70%) of this flow came from the Butler wash and buff operations. The remaining flow was comprised of wastewater from the roll department, boil-off, chrome electroplating and boiler operations. The wastewater influent to the lagoon remained essentially unchanged until July 20, 1990. At that time the wastewaters from the chromium electroplating, roll department and boiler (about 20%) were routed directly to the wastewater treatment system.

In July, 1991 all wastewaters were routed directly to the treatment system. The lagoon was dewatered by directing the remaining lagoon effluent to the treatment system. No wastewaters were discharged into the lagoon after July, 1991. Stormwater runoff that entered the lagoon was directed to treatment.

In May, 1994 **SECOR** began lagoon closure activities according to the approved Modified Closure Plan by isolating and stabilizing the waste sludge and soils using quick lime, and enclosing the material in a lined, capped cell within the bounds of the former lagoon. The entire site was seeded and mulched to complete the closure construction activities on November 19, 1994. A Closure Report dated December 9, 1994, documenting the closure activities was submitted to the State of Mississippi's Office of Pollution Control.

The geology of the site was evaluated when five monitoring wells were installed around the Equalization Lagoon during December, 1991 and March, 1992. Lithologic descriptions shown on the boring logs indicate that clayey or silty soils exist from the ground surface to a varying depth

between 5 and 6 feet below surface grade (BSG). Underlying the silt and clay layers is a medium grained sand layer. This layer extends to a depth of at least 20 feet BSG (the extent of the borings). The boring logs indicate that the shallowest continuous water bearing layer is this sand layer.

The water table was encountered in the borings between 10 and 16 feet BSG. Groundwater level measurements have been conducted periodically since installation of the existing shallow groundwater monitoring wells (MWRT-1, MWRT-2, MWRT-3, MWRT-4, and MWRT-5). Based on interpretation of these measurements, groundwater flows toward the northwest.

Given this information the existing groundwater monitoring wells were identified in relation to their position upgradient or downgradient of the lagoon.

<u>Well Identification</u>	<u>Gradient and Direction from the Lagoon</u>
MWRT-1	Up and East
MWRT-2	Cross and South
MWRT-3	Cross and South
MWRT-4	Down and West
MWRT-5	Down and North

These wells were sampled and analyzed monthly for comparison to quality objectives for volatile organic compounds, indicator parameters and metals. Levels of chromium in the groundwater collected from monitoring wells located south of the former Equalization Lagoon were shown to exceed the USEPA maximum contaminate level (MCL) for chromium (0.1 mg/L), while levels of chromium in the groundwater collected from the downgradient and east wells were shown to be below the USEPA MCL for chromium. All groundwater samples collected from both upgradient and downgradient monitoring wells had levels of TCE exceeding the USEPA MCL for TCE (0.005 mg/L). The highest levels of TCE were detected in the southern wells. Monitoring well RT-1 located upgradient and east demonstrated the lowest TCE levels.

A summary of past data collected from the sludge and subsoils in the lagoon as well as water quality from the monitoring wells in the vicinity of the lagoon are provided in Table 5-1 and 5-2.

5.2 Problem Definition

5.2.1 Additional Sampling for Interim Measures

Currently, there is insufficient information to evaluate Interim Measures. Specifically, more detailed information is needed regarding the horizontal and vertical distribution of VOCs and chromium (+6). This data could be provided through a sampling program using direct-push methods. The same sampling event will also be used to define the top and bottom of the shallow aquifer, as the thickness of the saturated interval and the depths to groundwater and the aquitard are important considerations in selecting a technology with respect to feasibility of construction methods. Further, existing data should be used to model groundwater flow, as the seepage velocity is critical to performance feasibility of some technologies. Additional soil data from the Site, including any of the SWMUs, would not be beneficial because they are all located substantially upgradient of the likely locations of the IM. Furthermore, in some cases it would be

difficult to assess whether constituents found in soil samples evolved from the SWMU or as a result of groundwater transport from an up-gradient source.

The proposed additional sampling event will supplement the RFI by including sampling and analysis of existing monitoring wells site-wide to provide current data regarding the distribution of key constituents in groundwater and will help identify trends in constituent concentrations throughout the plume. However, these data will not extend delineation to areas where an IM might be implemented. It is important to extend the delineation (utilizing direct-push technology) of TCE and its daughter products in two areas: (1) south from the outfall ditch along Riverdale Creek and (2) between the creek and the sludge lagoon. Both vertical and horizontal delineation are needed to select and design an IM. For example, zero valence metal barriers require sufficient retention time to achieve adequate reductions in constituent concentrations. The needed retention time depends upon the degradation rates and the concentrations of constituents entering the treatment system. The retention time achieved is dependent upon the groundwater seepage velocity and the thickness of the treatment system. These factors can determine whether such a system is appropriate for a specific Site or specific area of the Site. No long-term groundwater monitoring is proposed for that area at this time. Once an IM has been selected, a long-term groundwater monitoring program will be designed to meet the monitoring needs of the IM.

Detailed descriptions of the direct-push program and site wide groundwater sampling are presented in Section 6.0.

5.2.2 Equalization Lagoon Closure Project Objectives and Scope

The purpose of this monitoring program is to demonstrate the effectiveness of the Equalization Lagoon Closure over the next thirty years, as required by RCRA standards.

In order to achieve this goal, monitoring is required to ensure the appropriate performance and design of the constructed cell unit. The process of testing requires multiple sampling and analysis events to support statistical evaluation of the impact, if any, of the closure.

Table 5-1 1992 – 1994 Data Summary – Organic Concentration Ranges

Chemical	Sludge (ppm)	Subsoil (ppm)	Monitoring Well RT-1 (µg/L)	Monitoring Well RT-2 (µg/L)	Monitoring Well RT-5 (µg/L)	Monitoring Well RT-4 (µg/L)
Benzene	ND	ND	<5.0	<5000	<250	<250
1,1-Dichloroethane	ND	ND	<5.0	<5000	<250	<250
<i>t</i> -1,2-Dichloroethene	DNA	DNA	<5.0-5.8	2600-5700	<50-5200	3000-5400
<i>c</i> -1,2-Dichloroethene	DNA	DNA	<5.0	<5000	<5000	<250
Ethylbenzene	0.40-0.98	ND	<5.0	<5000	<5000	<250
Methylene Chloride	0.29-1.4	0.006-3.4	<5.0	<5000	<5000	<250
Tetrachloroethene	ND	ND	<5.0	<5000	<5000	<250
1,1,2-Trichloroethane	ND	ND	<5.0	<5000	<5000	<250
Trichloroethene	0.87-9,500	ND-82	87-170	53000-13000	290-860	4900-9400
Toluene	0.81-110	ND-1.3	<5.0	<5000	<5000	<250
Vinyl Chloride	ND-490	ND	<10.0	<5000	<5000	<250
Xylenes (total)	1.2-2.7	ND	DNA	DNA	DNA	DNA
1,2-Dichloroethene	1.7-6,500	ND-8.1	DNA	DNA	DNA	DNA
1,1,1-Trichloroethane	ND	ND	<5.0	<5000	<5000	<250
Chloroethane	ND	ND	<10	<10000	<10000	<500
Chloromethane	ND	ND	<10	<10000	<10000	<500
Chloroform	ND	ND	<5.0	<5000	<5000	<250
Styrene	ND	ND	DNA	DNA	DNA	DNA
1,1,2,2-Tetrachloroethane	ND	ND	<5.0	<5000	<5000	<250
1,1-Dichloroethene	ND	ND	<5.0	<5000	<5000	<250

Table 5-2 1992 – 1994 Data Summary – Metal Concentration Ranges

Chemical	Sludge (ppm)	Subsoil (ppm)	Monitoring Well RT-1 (mg/L)	Monitoring Well RT-2 (mg/L)	Monitoring Well RT-5 (mg/L)	Monitoring Well RT-4 (mg/L)
Arsenic	0.71-2.1	1.1-7.0	<0.010-0.12	<0.010-0.44	<0.010-0.023	<0.010-0.045
Barium	401-2,060	45.8-111	0.062-0.23	0.062-0.28	0.017-0.43	0.11-0.35
Cadmium	ND	<0.0050	0.0050	0.0050	0.0050	0.0050
Chromium	19,200-55,000	11.2-196	0.013-0.098	41-55	0.021-0.11	<0.010-0.058
Lead	104-638	ND-12.3	<0.005-0.022	<0.005-0.067	0.0056-0.032	<0.005-0.019
Mercury	ND	ND	<0.00020	<0.00020	<0.00020	<0.00020
Selenium	ND	ND	<0.050	<0.020	<0.050	<0.010
Silver	ND-2.6	ND	<0.010	<0.010	<0.010	<0.010

6.0 Task Description and Schedule

6.1 Interim Measures Direct Push Groundwater and Soil Sampling Task

Groundwater sampling using direct-push technology such as Geoprobe® will be conducted to provide additional data to supplement the IM evaluation. The objective of the Geoprobe® groundwater sampling is to determine the lateral and vertical extent of the groundwater plume along Riverdale Creek. Eight Geoprobe® sampling locations (see Figure 6-1) will be used to meet data needs. Two groundwater samples for volatile organic compounds (VOCs) will be collected from each location. One groundwater sample will be collected from the upper ten feet of the water table aquifer (approximately 20 feet) and the second sample will be collected from the lower portion of the aquifer (approximately 45 feet). The sample locations are positioned strategically between the extent of the plumes as currently known and Riverdale Creek to delineate the presence of constituents of concern.

One-inch piezometers will be installed at two locations to better define the groundwater flow direction and gradients in the area immediately upgradient of Riverdale Creek. The piezometers will be installed using direct-push methods within the upper portion of the water table aquifer, (approximately 25 feet). Each piezometer will be completed with a 4-inch diameter locking steel protective casing and surveyed for horizontal and vertical control. Two groundwater elevation measurement events will be performed utilizing the newly installed piezometers along with selected Site wells (approximately 25 locations). The initial event will be completed during the direct-push installation activities, while the second event will be completed about two weeks later.

Continuous soil cores will be collected from direct-push sampling locations GP-4, GP-6, and GP-7 to define the top and bottom of the shallow aquifer. The thickness of the saturated interval and the depths to groundwater and the aquitard are important considerations in selecting a technology with respect to feasibility of construction methods. The groundwater samples and soil cores will be collected in accordance the sampling procedures and requirements presented in Section 9.0.

6.2 Additional Interim Measures Groundwater Monitoring Task

During a meeting held at Grenada Manufacturing on April 25 and 26, 2000 the results of previous investigations and IM were discussed. The USEPA, MDEQ, Grenada Mfg., Meritor, and BC agreed that additional groundwater sampling would be performed to update the groundwater database and incorporate the updated information into the RFI Report (revised SOIW). Accordingly, a site-wide groundwater-sampling event will be conducted to supplement the IM study and update the RFI. Twenty-five (25) monitoring wells will be sampled and analyzed for VOCs, semi-volatile organic compounds (SVOCs), target analyte list (TAL) metals, and hexavalent chromium to assess current groundwater quality at the Site. In addition, these wells will be sampled for field analysis of indicator parameters for biodegradation of VOCs to include carbon dioxide, iron (11), manganese (11), hydrogen sulfide and dissolved oxygen. Table 6-1 presents a list of the monitoring wells to be sampled. The locations of the monitoring wells are presented on Figure 6-1. These 25 wells represent approximately 100 percent of the existing

SOURCE: MAP PREPARED BY ALMON ASSOCIATES, 1993. WELL LOCATIONS SHOWN ARE APPROXIMATE.

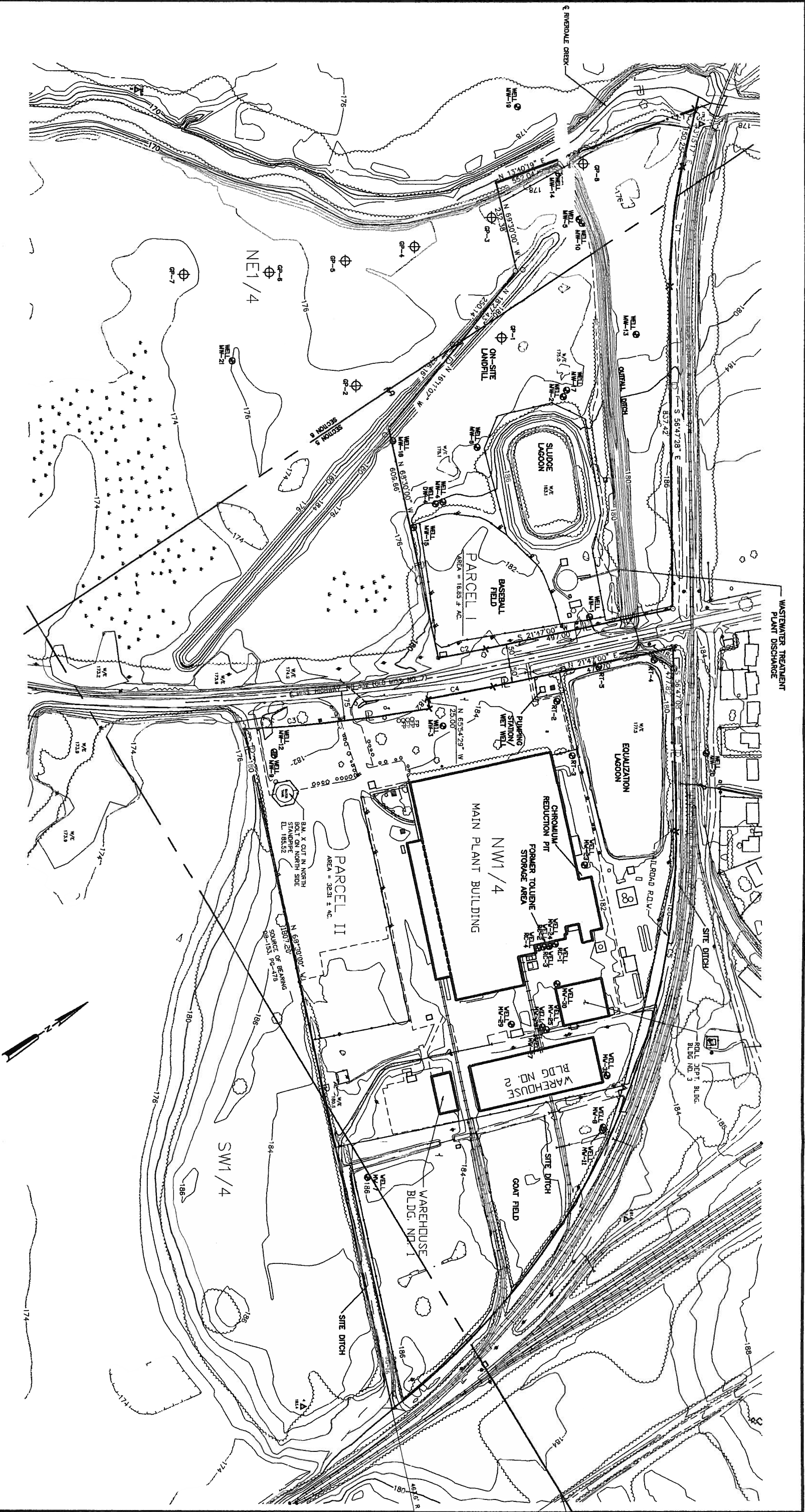


FIGURE 6-1
MONITORING WELL
GEOPROBE LOCATION MAP

GRENADA MANUFACTURING, LLC PLANT
GRENADA, MISSISSIPPI
19071.001
BROWN AND CALDWELL
Nashville, Tennessee
5/00

shallow and intermediate wells at the site. Table 6-2 presents the list of laboratory parameters to be analyzed. The available maximum contaminant levels (MCLs) only for the site constituents of concern are presented in Table 6-2. The methods and procedures that will be followed to conduct the groundwater sampling are presented in Section 9.0.

6.3 Equalization Lagoon Closure Sampling Task

Existing monitoring wells MWRT-1, MWRT-2, MWRT-4 and MWRT-5 will be used as sampling locations for the requirements of this monitoring program. These represent locations downgradient of the closed lagoon where potential impacts would be first detected.

Samples will be collected quarterly from each of the four listed wells for the first year of the project. The sampling frequency will drop to twice yearly for the four wells for the second through thirtieth years. Samples will be collected and analyzed for VOCs and TAL metals. Table 6-2 presents the list of laboratory parameters to be analyzed. The available maximum contaminant levels (MCLs) only for the site constituents of concern are presented in Table 6-2. The required methods and procedures to conduct the groundwater sampling are presented in Section 9.0.

Table 6-1 Interim Measures Work Plan – Monitoring Well Network

Well Name
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-17
MW-20
MW-23
MW-24
MW-25
MWRT-1
MWRT-2
MWRT-3
MWRT-4
MWRT-5

Table 6-2 Parameters to be Measured

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^a (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Aluminum	7429-90-5	3005A	6010B	NA		NA	50	12	
Antimony	7440-36-0	3005A	6010B	NA		NA	10	5.0	
Arsenic ^a	7440-38-2	3005A	6010B	NA	50	NA	5.0	3.0	X
Barium	7440-39-3	3005A	6010B	NA	2,000	NA	5.0	1.0	X
Beryllium	7440-41-7	3005A	6010B	NA		NA	5.0	0.20	
Cadmium	7440-43-9	3005A	6010B	NA	5	NA	1.0	0.30	X
Calcium	7440-70-2	3005A	6010B	NA		NA	1000	100	
Chromium (total) ^a	7440-47-3	3005A	6010B	NA	100	NA	5.0	1.0	X
Cobalt	7440-48-4	3005A	6010B	NA		NA	5.0	1.0	
Copper	7440-50-8	3005A	6010B	NA		NA	5.0	2.0	
Iron	7439-89-6	3005A	6010B	NA		NA	50	20	
Lead	7439-92-1	3005A	6010B	NA	15	NA	5.0	2.0	X
Magnesium	7439-95-4	3005A	6010B	NA		NA	1000	100	
Manganese	7439-96-5	3005A	6010B	NA		NA	5.0	1.0	
Mercury	7439-97-6	7470A	6010B	NA	2	NA	0.20	0.10	X
Nickel	7440-02-0	3005A	6010B	NA		NA	5.0	1.0	
Potassium	7440-09-7	3005A	6010B	NA		NA	1000	100	
Selenium	7782-49-2	3005A	6010B	NA	50	NA	5.0	2.0	X
Silver	7440-22-4	3005A	6010B	NA		NA	1.0	0.20	X
Sodium	7440-23-5	3005A	6010B	NA		NA	1000	100	
Thallium	7440-28-0	3005A	6010B	NA		NA	5.0	1.0	
Vanadium	07440-62-2	3005A	6010B	NA		NA	5.0	1.0	
Zinc	7440-66-6	3005A	6010B	NA		NA	10	1.0	
Chromium (hexavalent) ^a	7440-47-3	Modified 7196A	6010B	NA		NA	25	5.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^a (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Chloromethane	74-87-3	5030B	8260B	NA		5.0	5.0	2.0	X
Bromomethane	74-83-9	5030B	8260B	NA		5.0	5.0	3.0	
Vinyl Chloride^a	75-01-4	5030B	8260B	NA	2	5.0	5.0	2.0	X
Chloroethane	75-00-3	5030B	8260B	NA		5.0	5.0	2.0	X
Methylene Chloride	75-09-2	5030B	8260B	NA		5.0	5.0	1.0	X
Acetone	67-64-1	5030B	8260B	NA		5.0	10	5.0	
Carbon Disulfide	75-15-0	5030B	8260B	NA		5.0	5.0	1.0	
1,1-Dichloroethene^a	75-35-4	5030B	8260B	NA	7	5.0	5.0	1.0	X
1,1-Dichloroethane	75-34-3	5030B	8260B	NA		5.0	5.0	2.0	X
cis-1,2-Dichloroethene^a	156-59-4	5030B	8260B	NA	70	5.0	5.0	1.0	X
trans-1,2-Dichloroethene	156-60-5	5030B	8260B	NA		5.0	5.0	1.0	
Chloroform	67-66-3	5030B	8260B	NA		5.0	5.0	1.0	X
1,2-Dichloroethane^a	107-06-2	5030B	8260B	NA	5	5.0	5.0	1.0	X
2-Butanone (Methyl Ethyl Ketone)	78-93-3	5030B	8260B	NA		5.0	15	10	X
1,1,1-Trichloroethane	71-55-6	5030B	8260C	NA		5.0	5.0	1.0	
Carbon Tetrachloride	56-23-5	5030B	8260C	NA		5.0	5.0	1.0	
Bromodichloromethane	75-27-4	5030B	8260C	NA		5.0	5.0	1.0	
1,2-Dichloropropane	78-87-5	5030B	8260C	NA		5.0	5.0	1.0	
cis-1,3-Dichloropropene	10061-01-5	5030B	8260C	NA		5.0	5.0	1.0	
Trichloroethene^a	79-01-6	5030B	8260C	NA	5	5.0	5.0	1.0	X
Dibromochloromethane	124-48-1	5030B	8260C	NA		5.0	5.0	1.0	
1,1,2-Trichloroethane^a	79-00-5	5030B	8260C	NA	5	5.0	5.0	1.0	
Benzene^a	71-43-2	5030B	8260C	NA	5	5.0	5.0	1.0	X
trans-1,3-Dichloropropene	10061-02-6	5030B	8260C	NA		5.0	5.0	1.0	
Bromoform	75-25-2	5030B	8260C	NA		5.0	5.0	1.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^a (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	108-10-1	5030B	8260C	NA		5.0	5.0	2.0	
2-Hexanone	591-78-6	5030B	8260C	NA		5.0	5.0	2.0	
Tetrachloroethene^a	127-18-4	5030B	8260C	NA	5	5.0	5.0	1.0	X
1,1,2,2-Tetrachloroethane	79-34-5	5030B	8260C	NA		5.0	5.0	1.0	X
Toluene^a	108-88-3	5030B	8260C	NA	1000	5.0	5.0	1.0	X
Chlorobenzene	108-90-7	5030B	8260C	NA	100	5.0	5.0	1.0	X
Ethylbenzene	100-41-4	5030B	8260C	NA	700	5.0	5.0	1.0	X
Styrene	100-42-5	5030B	8260C	NA	100	5.0	5.0	1.0	X
Xylenes (total)	1330-20-7	5030B	8260C	NA	10,000	5.0	5.0	1.0	X
(<i>m/p</i> -Xylenes)	108-38-3	5030B	8260C	NA		5.0	5.0	1.0	
(<i>o</i> -Xylenes)	95-47-6	5030B	8260C	NA		5.0	5.0	1.0	
Phenol	108-95-2	3510C	8270C	3640A		10	5.0	1.0	
bis(2-Chloroethyl)ether	111-44-4	3510C	8270C	3640A		10	5.0	2.0	
2-Chlorophenol	95-57-8	3510C	8270C	3640A		10	5.0	2.0	
1,3-Dichlorobenzene	541-73-1	3510C	8270C	3640A		10	5.0	2.0	
1,4-Dichlorobenzene	106-46-7	3510C	8270C	3640A		10	5.0	2.0	
1,2-Dichlorobenzene	95-50-1	3510C	8270C	3640A		10	5.0	2.0	
2-Methylphenol	95-48-7	3510C	8270C	3640A		10	5.0	2.0	
2,2-oxybis(1-Chloropropane)	108-60-1	3510C	8270C	3640A		10	5.0	2.0	
4-Methylphenol	106-44-5	3510C	8270C	3640A		10	5.0	4.0	
N-Nitroso-di-n-propylamine	621-64-7	3510C	8270C	3640A		10	5.0	2.0	
Hexachloroethane	67-72-1	3510C	8270C	3640A		10	5.0	1.0	
Nitrobenzene	98-95-3	3510C	8270C	3640A		10	5.0	1.0	
Isophorone	78-59-1	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^p (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
2-Nitrophenol	88-75-5	3510C	8270C	3640A		10	5.0	1.0	
2,4-Dimethylphenol	105-67-9	3510C	8270C	3640A		10	5.0	2.0	
bis(2-Chloroethoxy)methane	111-91-1	3510C	8270C	3640A		10	5.0	1.0	
2,4-Dichlorophenol	120-83-2	3510C	8270C	3640A		10	5.0	2.0	
1,2,4-Trichlorobenzene	120-82-1	3510C	8270C	3640A		10	5.0	2.0	
Naphthalene	91-20-3	3510C	8270C	3640A		10	5.0	2.0	
4-Chloroaniline	106-47-8	3510C	8270C	3640A		10	5.0	1.0	
Hexachlorobutadiene	87-68-3	3510C	8270C	3640A		10	5.0	2.0	
4-Chloro-3-methylphenol	59-50-7	3510C	8270C	3640A		10	5.0	2.0	
2-Methylnaphthalene	91-57-6	3510C	8270C	3640A		10	5.0	2.0	
Hexachlorocyclopentadiene	77-47-4	3510C	8270C	3640A		10	5.0	1.0	
2,4,6-Trichlorophenol	88-06-2	3510C	8270C	3640A		10	5.0	2.0	
2,4,5-Trichlorophenol	95-95-4	3510C	8270C	3640A		10	5.0	2.0	
2-Chloronaphthalene	91-58-7	3510C	8270C	3640A		10	5.0	2.0	
2-Nitroaniline	88-74-4	3510C	8270C	3640A		10	5.0	2.0	
Dimethylphthalate	131-11-3	3510C	8270C	3640A		10	5.0	1.0	
Acenaphthylene	208-96-8	3510C	8270C	3640A		10	5.0	2.0	
2,6-Dinitrotoluene	606-20-2	3510C	8270C	3640A		10	5.0	1.0	
3-Nitroaniline	99-09-2	3510C	8270C	3640A		10	10	2.0	
Semivolatile Organic Analytes (SW-846 8270C)									
Acenaphthene	83-32-9	3510C	8270C	3640A		10	5.0	2.0	
2,4-Dinitrophenol	51-28-5	3510C	8270C	3640A		10	10	7.0	
4-Nitrophenol	100-02-7	3510C	8270C	3640A		10	10	3.0	
Dibenzofuran	132-64-9	3510C	8270C	3640A		10	5.0	2.0	
2,4-Dinitrotoluene	121-14-2	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^p (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Diethylphthalate	84-66-2	3510C	8270C	3640A		10	5.0	1.0	
4-Chlorophenyl-phenylether	7005-72-3	3510C	8270C	3640A		10	5.0	2.0	
Fluorene	86-73-7	3510C	8270C	3640A		10	5.0	1.0	
4-Nitroaniline	100-01-6	3510C	8270C	3640A		10	10	2.0	
4,6-Dinitro-2-methylphenol	534-52-1	3510C	8270C	3640A		10	10	4.0	
N-Nitrosodiphenylamine ⁹	86-30-6	3510C	8270C	3640A		10	5.0	2.0	
4-Bromophenyl-phenylether	101-55-3	3510C	8270C	3640A		10	5.0	2.0	
Hexachlorobenzene (HCB)	118-74-1	3510C	8270C	3640A		10	5.0	2.0	
Pentachlorophenol	87-86-5	3510C	8270C	3640A		10	10	5.0	
Phenanthrene	85-01-8	3510C	8270C	3640A		10	5.0	2.0	
Anthracene	120-12-7	3510C	8270C	3640A		10	5.0	2.0	
Carbazole	86-74-8	3510C	8270C	3640A		10	5.0	2.0	
Di-n-butylphthalate	84-74-2	3510C	8270C	3640A		10	5.0	2.0	
Fluoranthene	206-44-0	3510C	8270C	3640A		10	5.0	2.0	
Pyrene	129-00-0	3510C	8270C	3640A		10	5.0	2.0	
Butylbenzylphthalate	85-68-7	3510C	8270C	3640A		10	5.0	2.0	
3,3'-Dichlorobenzidine	91-94-1	3510C	8270C	3640A		10	10	2.0	
Benzo(a)anthracene	56-55-3	3510C	8270C	3640A		10	5.0	2.0	
Chrysene	218-01-9	3510C	8270C	3640A		10	5.0	1.0	
bis(2-Ethylhexyl)phthalate ^a	117-81-7	3510C	8270C	3640A	6	10	5.0	2.0	
Di-n-octylphthalate	117-84-0	3510C	8270C	3640A		10	5.0	2.0	
Benzo(b)fluoranthene	205-99-2	3510C	8270C	3640A		10	5.0	2.0	
Benzo(k)fluoranthene	207-08-9	3510C	8270C	3640A		10	5.0	2.0	
Benzo(a)pyrene	50-32-8	3510C	8270C	3640A		10	5.0	2.0	
Indeno(1,2,3-cd)pyrene	193-39-5	3510C	8270C	3640A		10	5.0	2.0	

Table 6-2 Parameters to be Measured, Continued

Analyte	CAS #	SW-846 Preparation Method	SW-846 Analytical Method	SW-846 Clean-Up Method	MCLs ^b (ug/L)	Analytical PQL MDL (ug/L)	Laboratory PQL (ug/L)	Laboratory MDL (ug/L)	Equalization Lagoon Analytes
Dibenz(a,h)anthracene	53-70-3	3510C	8270C	3640A		10	5.0	2.0	
Benzo(g,h,i)perylene	191-24-2	3510C	8270C	3640A		10	5.0	2.0	

^a – RFI Constituent of Concern

^b – MCL for RFI Constituent of Concern and Equalization Lagoon Constituents of Concern based on National Primary Drinking Water Standards (EPA 810-F-94-001), December 1999.

NA = Not Applicable

Source: SW-846 Third Addition Final Up-date 3

6.4 Field Quality Assurance/Quality Control Sampling

QA/QC samples will be systematically collected during each field sampling event. These samples generate data to evaluate the quality of both field and laboratory procedures. Table 6-3 summarizes the numbers of samples to be collected. Procedures for reporting QA/QC results are discussed in Sections 17.0, 18.0, and 19.0.

Table 6-3 Field and Quality Control Sample Summary (perevent)

Interim Measures Sampling

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs ¹	No. of Lab Splits ²	No. of MS	No. of MSD	No. of Trip Blanks ²	No. of Field Blanks ²	No. of PE Samples
Groundwater	VOC	Low	8260B	41	2	0	2	2	NA	2	NA
Groundwater	SVOC	Low	8270C	25	1	0	1	1	NA	1	NA
Groundwater	TAL Metals	Low	6010, 9012	25	1	0	1	1	NA	1	NA

Equalization Lagoon Closure Sampling

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs ¹	No. of Lab Splits ²	No. of MS	No. of MSD	No. of Trip Blanks ²	No. of Field Blanks ²	No. of PE Samples
Groundwater	VOC	Low	8260B	4	1	0	1	1	NA	1	NA
Groundwater	TAL Metals	Low	6010, 9012	4	1	0	1	1	NA	1	NA

1. Field quality control
 2. Laboratory quality control
- NA = Not applicable.

6.5 Project Schedule

6.5.1 Interim Measure Additional Sampling Schedule

Once USEPA approval is received on this QAPP, field activities will be initiated within two weeks. Sampling is expected to take about one week and analytical results will be provided within about three weeks of sample receipt. The additional data will be incorporated into the RFI Report and the final report transmitted to the agencies within about six weeks of receipt of analytical data. Therefore, the Final RFI Report can be submitted within about 12 weeks of receipt of approval of the QAPP.

6.5.2 Equalization Lagoon Closure Sampling

Samples will be collected quarterly for each of the four wells (MWRT-1, MWRT-2, MWRT-4, and MWRT-5) for the first year of the project. The sampling frequency will drop to twice yearly for the four wells for the second through thirtieth year. Samples will be analyzed for the parameters indicated in Table 6-2.

7.0 Project Quality Objectives and Measurement Performance Criteria

7.1 Data Quality Objective Process

The following presents the data quality objectives process that has been established for the site.

State the Problem — Provide a description of the problem(s), specifications of available resources, and relevant deadlines for the study.

- (1) *Members of the planning team* — The members of the planning team for the RCRA Corrective Action will include John Bozick, Arvin Meritor's Project Manager; Dale Showers, BC's Project Manager; Greg Christians, BC Task Manager; and Ron Burt, BC's QA Officer.

The members of the planning team for the Equalization Lagoon Closure Monitoring will include John Kandler, Textron's Project Manager; Caleb Daba, ECO-Systems Project Manager; Stein Reide, ECO System's Task Manager; and Carol Bullock, ECO-System's QA Officer.

- (2) *Primary decision maker* — There will not be a primary decision maker; decisions will be made by consensus.
- (3) *Description of the problem* — See Section 5.2.1.
- (4) *Available resources and relevant deadlines for the study* — Arvin Meritor and Textron are committed to providing the necessary resources to complete the specified scope of work on the schedule outlined in Section 6.5.

Identify the Decision — Provide a statement of the decision that will use environmental data and the actions that could result from this decision.

- (1) *The principal study question* —

RCRA Corrective Action - Is the current distribution of the site parameters of concern consistent with that observed during the initial investigation? Is Riverdale Creek being impacted by site parameters of concern? These questions will be addressed to support the design of IM at the site.

Equalization Lagoon Closure- Is groundwater quality being impacted by the closed Equalization Lagoon?

- (2) *Alternative actions that could result from resolution of the principal study question* — The selection and design of site-specific IMs.

- (3) *Combine the principal study question and the alternative actions into a decision statement —*

RCRA Correction Action- Once the distribution of site parameters of concern and potential impacts to Riverdale Creek have been defined, site-specific IMs will be designed and implemented.

Equalization Lagoon Closure – If impacts to groundwater quality are observed, potential corrective action will be evaluated.

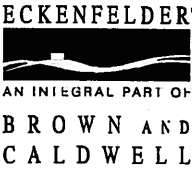
Identify the Inputs to the Decision — Provide a list of the environmental variables or characteristics that will be measured and other information needed to resolve the decision statement.

- (1) *Information that will be required to resolve the decision statement —* Obtain measurements of the site parameters listed in Table 6-2 in site groundwater.
- (2) *Sources for each item of information identified —* Groundwater will be sampled following the scope of work outlined in Section 6.0. The parameter list is presented in Table 6-2.
- (3) *Information that is needed to establish the action level —* The action level will be based on the applicable RCRA regulations and the site-specific risk assessment.
- (4) *Confirm that appropriate measurement methods exist to provide the necessary data —* Groundwater quality data will be analyzed in accordance with EPA SW-846 methods.

Define the Boundaries of the Study — Provide a detailed description of the spatial and temporal boundaries of the problem, characteristics that define the population of interest, and any practical considerations for the study.

- (1) *Characteristics that define the population of interest —* Groundwater in the shallow aquifer beneath and down-gradient of the site will be analyzed.
- (2) *The spatial boundary of the decision statement —*
 - (a) *The geographic area to which the decision statement applies.* Decisions will apply to source areas and impacted groundwater down-gradient of the source areas.
- (3) *The temporal boundary of the decision statement —*
 - (a) *The timeframe to which the decision statement applies.* It will be assumed that the sampling data represent the current concentration of site parameters of concern within groundwater.

Figure 10-1: Groundwater Sampling Field Data Sheet

 <p>ECKENFELDER® AN INTEGRAL PART OF BROWN AND CALDWELL</p>	<p>GROUNDWATER SAMPLING FIELD DATA SHEET</p> <p>Location No. _____</p> <p>Sample No. _____</p>																																																	
<p>Project: _____</p> <p>Client: _____</p> <p>Job No.: _____</p> <p>Personnel: _____</p> <p>Comments: _____</p>	<p>Date: _____ Time: _____</p> <p>Weather Conditions: _____</p> <p>Air Temperature: _____</p>																																																	
<p>WELL DATA:</p> <p>Casing Diameter (in.) _____ Stainless Steel Steel PVC Teflon</p> <p>Intake Diameter (in.) _____ Stainless Steel Steel PVC Teflon Open Rock</p> <p>Bottom Depth (ft.) _____ Datum Top of Pro. Casing Datum Top of Well Casing Other: _____</p> <p>Static Water Level (ft.) _____ Well Bottom Clean Well in Good Condition</p> <p>Volume of Water in Well (gal.): _____</p>																																																		
<p>PURGING DATA:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 15%;">Method:</td> <td style="width: 15%;">Bladder</td> <td style="width: 15%;">Peristaltic</td> <td style="width: 15%;">Bailer</td> <td style="width: 15%;">Submersible</td> <td style="width: 20%;"></td> <td style="width: 15%;">Was The Well Evacuated?</td> </tr> <tr> <td></td> <td></td> <td>Teflon</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Materials:</td> <td></td> <td>Stainless Steel</td> <td></td> <td>Materials:</td> <td></td> <td>Polypropylene</td> </tr> <tr> <td>Pump/Bailer:</td> <td></td> <td>PVC</td> <td></td> <td>Tubing/Rope:</td> <td></td> <td>Nylon</td> </tr> <tr> <td></td> <td></td> <td>Other: _____</td> <td></td> <td></td> <td></td> <td>Other: _____</td> </tr> <tr> <td>Purging Equipment:</td> <td></td> <td>Dedicated</td> <td>Prepared Off-site</td> <td>Field Cleaned</td> <td></td> <td></td> </tr> <tr> <td>Purge Start Time</td> <td>_____</td> <td>Purge End Time</td> <td>_____</td> <td>Volume Pumped</td> <td>_____</td> <td></td> </tr> </table> <p style="text-align: center; margin-top: 10px;"> Time Series Data: <u>Volume</u> <u>Temperature</u> <u>Ph</u> <u>Spec. Cond.</u> <u>Color</u> </p>		Method:	Bladder	Peristaltic	Bailer	Submersible		Was The Well Evacuated?			Teflon					Materials:		Stainless Steel		Materials:		Polypropylene	Pump/Bailer:		PVC		Tubing/Rope:		Nylon			Other: _____				Other: _____	Purging Equipment:		Dedicated	Prepared Off-site	Field Cleaned			Purge Start Time	_____	Purge End Time	_____	Volume Pumped	_____	
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Sampling Equipment:	Dedicated	Prepared Off-site	Field Cleaned																																															
Metals Sample Field Filtered		Filtering Method:	_____																																															
<p>PHYSICAL & CHEMICAL DATA:</p> <p>Appearance: Clear Turbid Color: _____</p> <p>Contains Immiscible Liquid Other: _____</p> <p>Field Determinations: Temperature _____ pH _____ Spec. Cond. _____</p>																																																		
<p>I Certify that this sample was collected and handled in accordance with applicable regulatory and corporate protocols.</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%; text-align: center;"> _____ Signature </div> <div style="width: 45%; text-align: center;"> _____ Date </div> </div>																																																		

**Figure 10-2
GROUNDWATER SAMPLE
COLLECTION REPORTS**

Location No. _____

Sample No. _____

Project: _____

Date: _____ **Time:** _____

Client: _____

Weather Conditions: _____

Job No.: _____

Air Temperature: _____

Personnel: _____

Type of Sample: Water Soil

Physical Description of Sample Location:

Bottom Sediment

(If required) _____

Solid: _____

Other: _____

PREPARATION FOR SAMPLING:

Has equipment been dedicated to sample location?

Has equipment been prepared off site prior to sampling?

Has equipment been cleaned and reused in field?

Cleaning Method: _____

Other Data: _____

COLLECTION OF SAMPLE:

Equipment Utilized: _____

Method: _____

Sample Type Composite Grab Other: _____

Other Data: _____

FIELD MEASUREMENT DATA:

Appearance: _____

Odor: Yes _____ No _____

Field Determinations:

Temperature : _____ **pH:** _____ **Spec. Cond.** _____

Other(s): _____

REMARKS:

I CERTIFY THAT THIS SAMPLE WAS COLLECTED AND HANDLED IN ACCORDANCE WITH APPLICABLE REGULATORY AND CORPORATE PROTOCOLS. THESE DATA ARE COMPILED FROM FIELD RECORDS IN A BOUND FIELD BOOK.

Signature

Date

10.3 Sample Chain-of-Custody

A chain-of-custody (COC) form will be completed after sample collection and master field log documentation. The chain-of-custody forms will accompany the samples to the laboratory. The field personnel collecting the samples will be responsible for the custody of the samples until transportation to the laboratory. Sample transfer will require the individuals relinquishing and receiving the samples to sign, date, and note the time on the chain-of-custody forms.

10.4 Laboratory Chain of Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage; tracking during sample preparation and analysis; and storage of data are described in the laboratory SOPs and laboratory Quality Manuals. A summary of the process is described below.

On arrival at the laboratory, all samples will be inspected thoroughly to confirm that the integrity of the samples and containers has not been compromised. The cooler custody seals will be inspected to verify that they are still intact and were properly signed and dated by the field sampling team. The temperature of the cooler temperature blank will be determined and recorded. If the temperature of the cooler blank does not fall into the range of 4 ± 2 °C the Project Manager will be notified immediately. The exception to this will be if samples are delivered from the site same-day to the laboratory. In this circumstance the cooler temperature blank and samples may not have cooled during transport and elevated temperatures will be considered acceptable as long as ice is present in the cooler. The individual sample containers will be inspected to verify that each has a sample label. The condition of the samples will be noted on the COC form.

The sample containers will be checked against the accompanying COC to verify that the cooler contents are identical to the samples described on the COC documents. If discrepancies exist, they will be reported to the Laboratory Project Manager, who will immediately notify the Project Manager. The problem will be resolved, in writing, before analytical work begins.

After the Laboratory Sample Custodian has determined that the samples are in satisfactory condition and the documents are in order, a sample log-in sheet will be initiated and will serve as documentation of the condition of the samples upon receipt and their assigned laboratory numbers.

After the samples have been entered into the laboratory tracking system, copies of the log-in forms and COC records will be sent to the Project Manager, who will verify that the specified samples and parameters correspond to the samples and parameters identified in the QAPP. The samples will be placed in a secured storage area, under the conditions called for by the analytical method, until removed for analysis.

Samples delivered on Saturday will be received by the Laboratory Sample Custodian and placed in a secure location until they can be logged in on the next business day.

10.5 Sample Archival

Samples and sample extracts for all analyses will be held under custody at 4 ± 2 °C by the laboratory for 60 days after the laboratory's final report is issued.

11.0 Field Analytical Methods

Conductivity, temperature, pH and ORP meters will be used to collect field measurements. Several other non-critical indicator measurements (carbon dioxide, iron (II), manganese (II), hydrogen sulfide, and dissolved oxygen) will be made in the field as well. The methods and procedures for these measurements are presented in Appendix A.

12.0 Laboratory Analytical Method Requirements

Table 12-1 describes the tests to be performed on the samples collected during this monitoring program.

Table 12-1 Tests and Methods for the Groundwater Monitoring Program

Test	Matrix	SW-846 Method	Laboratory
Metals	Water	6010B/7196A/7470A	ELAB/Pace analytical Services
VOAs	Water	8260B	ELAB/Pace analytical Services
SVOAs	Water	8270C	ELAB/Pace analytical Services

Table 6-2 of this QAPP sets forth the analytes required for each method. Table 6-2 also presents the required extraction and clean-up method for each analyte.

All instruments used to perform chemical measurements must be properly calibrated prior to and during use to ensure acceptable and valid results. This section describes the procedures necessary for maintaining the accuracy of all the instrumentation used in the field tests and the laboratory analyses. The accuracy and traceability of all calibration standards used must be properly documented. The procedures described herein are to be used in conjunction with specific instrument manufacturer's instructions, applicable analytical methodology requirements, and specific laboratory/field procedures for instrument operation.

The required turn-around time for this product is 25 business days.

12.1 Laboratory Instruments

The methodologies selected for use in this investigation specify the types and frequency of calibrations. For all analytical procedures, the lowest calibration standard analyzed must be at or below the project required reporting limit for the specific medium being tested to ensure accurate reporting limit determinations.

Other laboratory equipment such as refrigerators, balances and ovens required for the storage and preparation of samples must be calibrated and/or monitored with the following guidelines:

- Equipment must be checked daily and these records kept in a logbook or calibration-specific log
- The laboratory must document clearly the acceptance criteria for all such equipment (e.g., refrigerator temperature must be $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and corrective actions must be taken for any out-of-control situation as described in the laboratory's Quality Manual
- The equipment must not be used after corrective action until it has been recalibrated or verified through the successful analysis of a check standard
- Calibrations of other miscellaneous analytical equipment (e.g., automatic pipettes) must be performed according to manufacturer's recommendations

Implementation of the laboratory calibrations will be the responsibility of the Laboratory Manager and the analysts performing the procedures.

12.2 Laboratory Instrument Preventative Maintenance

As part of the laboratory's Quality Manual, a routine preventative maintenance program is conducted by the laboratory to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees regularly perform routine scheduled maintenance and repair of (or coordinate with the vendor for the repair of) all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications. The preventive maintenance program should include:

- An inventory of replacement and spare parts for instruments that are maintained.
- Maintenance logbooks for each instrument with information on routine and non-routine procedures. The logbook records must include the instrument number, description of malfunction or problem, date of maintenance activity, the type of activity performed, and final resolution.
- Training of laboratory staff in the maintenance requirements of the instruments. Preventive maintenance schedules and activities will be outlined in the laboratory SOPs.

12.2.1 Inductively Coupled Plasma Spectroscopy

The Inductively Coupled Plasma Argon (ICP) Spectrometer should be maintained under service contract with the manufacturer. Routine preventive maintenance should include:

- Checking pump tubing and replacing when necessary.
- Checking nebulizer for even "spray" and cleaning as necessary.
- Checking the torch for plasma height and shape and cleaning as necessary.
- Checking sensitivity of photomultiplier and replacing as necessary.

12.2.2 Gas Chromatograph Instruments

The GC and GC/MS systems will be maintained on a service contract or undergo in-house maintenance to provide routine preventive maintenance. Spare parts for the GC and GC/MS systems should include: filaments, electron multiplier, source parts, o-rings, ferrules, septa, injection port liners, and columns. Routine preventive maintenance for the systems should include:

- Checking the data systems (disk drives, tape readers, etc.) and servicing, as necessary.
- Changing oil and traps on mechanical and turbo pumps.
- Conditioning of moisture traps, every two months or when the gas source is changed.
- Carrier gas evaluation and leak checking of electron capture detector when the gas or column is changed.
- Servicing the MS source through cleaning, replacement of filaments and other source parts, as necessary.
- Replacement of injection port septa and liners, as necessary.

- Clipping the front end of GC column or replacement of GC column, as necessary.

12.2.3 Atomic Absorption Instruments

The atomic absorption (AA) systems will be maintained on a service contract or undergo in-house maintenance to provide routine preventive maintenance. Routine preventive maintenance procedures should include:

- Cleaning the furnace windows.
- Checking the plumbing connections.
- Changing the graphite tube.
- Checking the gases.
- Checking the autosampler and tubing.

12.2.4 Thermometers

Thermometers for refrigerators and ovens are calibrated yearly against National Institute of Standards and Technology (NIST) certified thermometers. The Laboratory QA Officer will be responsible for the safekeeping of the NIST thermometers and for the documentation asserting the accuracy of their measurements.

12.2.5 Analytical Balances

Virtually every analytical procedure requires the use of side-loading and/or top-loading balances. Many of these requirements involve standards preparation and are, therefore, crucial to accurate determination. Balances should be maintained on a service contract. A calibration status label is affixed to each balance after calibration during servicing.

12.3 Inspection/Acceptance Requirements for Supplies and Consumables

For this project, critical supplies will be tracked in the following manner.

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
Sample containers/lids	Visually inspected upon receipt for cracks, breakage, cleanliness. Must be accompanied by certificate of analysis.	Requisitioner
Chemicals and reagents	Visually inspected for proper labeling, expiration dates, appropriate grade. Standards must be accompanied by certificate of analysis.	Requisitioner
General Supplies and spare parts	Visually inspected to ensure that the correct items were received in working or usable condition.	Requisitioner

Supplies and consumables not meeting acceptance criteria will initiate the appropriate corrective action. Corrective measures may include repair or replacement of measurement equipment, and/or notification of vendor and subsequent replacement of defective or inappropriate materials. All actions should be documented in the project files.

13.0 Quality Control Requirements

13.1 Sampling Quality Control

Table 13-1 Field Sampling QC for VOC, SVOC and, TAL Metals

Field QC:	Frequency	Method/SOP Acceptance Limits	Corrective Action (CA)	Persons Responsible for CA	Data Quality Indicator	Measurement Performance Criteria
Field Blank ¹	1 per medium per 20 field samples collected, or 1 per medium per event if fewer than 20 samples collected.	All compounds of interest \leq RL	Qualify data	Task Manager	Evaluate cleanliness of sample containers and sample handling and collection procedures	All compounds of interest \leq RL
Cooler Temperature Blanks	One per cooler.	$4 \pm 2^{\circ}\text{C}$	Qualify data. Reject data or resample for excessively high temps ²	QA Coordinator/ Project Manager	Evaluate representativeness and bias	$4 \pm 2^{\circ}\text{C}$
Field Duplicate ³	1 per medium per 20 field samples, or 1 per medium per event if fewer than 20 samples collected.	$\pm 50\%$ RPD with provisions for wider acceptance limits near the detection limits	Compare to matrix duplicates, check for possible matrix interferences or improper sample collection procedure, qualify data	Data Validator	Evaluate precision and representativeness taking into account variability of sample matrix	$\pm 50\%$ RPD with provisions for wider acceptance limits near the detection limits
Matrix spike/ matrix spike duplicate	1 per 20 field samples will be designated for MS/MSD analysis and additional samples volume will be provided for the test.	$\pm 50\%$ RPD with provisions for wider acceptance limits near the detection limits	Check for possible matrix interferences, review laboratory procedures for variations or improper sample collection procedure, qualify data	Laboratory Analyst/ Data Validator	Evaluate precision and representativeness taking into account variability of sample matrix and laboratory practices.	$\pm 50\%$ RPD with provisions for wider acceptance limits near the detection limits

- Field blanks are prepared by collecting sample from new building materials with dedicated sampling equipment.
- The exception to this will be if samples are delivered from the site same day to the laboratory. In this circumstance the cooler temperature blank and samples may not have cooled during transport and elevated temperatures will be considered acceptable as long as ice is present in the cooler.
- A field duplicate is a split sample with both portions sent to the same lab.
- A field laboratory split is a split sample with the portions sent to different labs.

13.2 Analytical Laboratory Quality Control

Table 13-2 Laboratory Sample QC Table for VOCs, SVOCs & Metals

Type	Frequency	Criteria	Corrective Action (CA)	Person Responsible for CA	Data Quality Indicator	Measurement Performance Criteria
Method Blank	Minimum of 1 per analytical batch or per 20 field samples; whichever is less	All compounds of interest < RL	Reanalyze; if blank still exceeds criteria, clean and recalibrate system; document corrective action, evaluate/prepare/reanalyze samples	Laboratory Analyst/Area Manager	Evaluate cleanliness of sample preparation and analysis procedures	All compounds of interest should be < RL
Instrument Blank	As required in method	All compounds of interest < RL	Reanalyze; if second blank exceeds criteria, clean system; document corrective action	Laboratory Analyst	Evaluate cleanliness of instrumentation	All compounds of interest should be < RL
Matrix Spike	At least 1 per preparation batch or as requested on COC	Meet %R requirements in Tables 7-2 and 7-3	Reanalyze samples if necessary. Qualify data if criteria are still not met.	Laboratory Analyst/Area Manager	Evaluate accuracy and representativeness taking into account variability of sample matrix	Meet %R requirements in Tables 7-2 and 7-3
Matrix Spike Duplicates (except metals)	At least 1 per preparation batch or as requested on COC	Meet %R requirements in Tables 7-2 and 7-3	Reanalyze samples if necessary. Qualify data if criteria are still not met.	Laboratory Analyst/Area Manager	Evaluate precision, accuracy, and representativeness taking into account variability of sample matrix	Meet %R requirements in Tables 7-2 and 7-3
Laboratory Duplicate (metals only)	At least 1 per preparation batch or as requested on COC	Meet RPD requirements in Tables 7-2 and 7-3	Reanalyze samples. Qualify data if criteria are still not met.	Laboratory Analyst/Area Manager	Evaluate precision and representativeness taking into account variability of sample matrix	Meet RPD requirements in Tables 7-2 and 7-3
LCS	1 per medium per 20 field samples or per laboratory sample batch, whichever is less	Lab/regulatory generated; recoveries as specified in Tables 7-2 and 7-3	Check if MS/MSD acceptable to compare for matrix effects. Evaluate the bias in relation to sample result. Reanalysis may be required. Data may require qualifiers.	Laboratory Analyst/Area Manager	Evaluate accuracy	Vendor-supplied: Within the 95% confidence interval/ vendor supplied limits Lab-generated: recoveries as specified in Tables 7-2 and 7-3
Initial Calibration	As specified in method	As specified in methods	Recalibrate; check system	Laboratory Analyst	Establish instrument response and linearity.	As specified in methods

Table 13-2 Laboratory Sample QC Table for VOCs, SVOCs & Metals (Continued)

Type	Frequency	Criteria	Corrective Action (CA)	Person Responsible for CA	Data Quality Indicator	Measurement Performance Criteria
Calibration Check Sample	As specified in method	90-110% recovery for most inorganics; as specified in EPA methods for organics listed in Tables 7-2 and 7-3	Recalibrate; check system, reanalyze affected samples	Laboratory Analyst	Evaluate stability and accuracy of instrumentation.	90-110% recovery for most inorganics; as specified in EPA methods for organics listed in Table 7-2 and 7-3
Surrogates	All GC/MS and GC samples for organic analyses	Recoveries as specified in Table s 7-2 and 7-3	Evaluate data; samples may require reanalysis and/or qualification	Laboratory Analyst/ Area Manager	Evaluate accuracy of sample preparation and effect of matrix on preparation	Recoveries as specified in Table s 7-2 and 7-3

RL = Reporting Limit

MS = Matrix Spike Sample

MSD = Matrix Spike Duplicate Sample

MD = Matrix Duplicate Sample

SRM = Standard Reference Material

LCS = Laboratory Control Sample

RPD = Relative Percent Difference (between duplicate results)

GC = Gas Chromatography

GC/MS = Gas Chromatography/Mass Spectrometry

14.0 Documentation, Records, and Data Management

14.1 Project Documentation and Records

Project documents will be controlled through an organized project filing system. Project and task numbers will be printed on each document. Analytical/technical files will include work products generated during the project. Field books, field observations, photographs, and other field related documents will be prepared and will also be placed in the project files. Laboratory sample results will be controlled, reviewed, and validated. Original incoming documents will be date-stamped upon arrival and will be placed in the files.

The project manager will contact the analytical laboratories, subcontractor, or privates' sources twice prior to receiving the data report to review the report status. This will provide an opportunity to identify potential QA issues or potential delivery delays. This will also provide an opportunity to implement corrective actions when most appropriate.

Data received from the field, analytical laboratories, subcontractors, or private sources will be tabulated on a spreadsheet or database and will be subjected to quality control procedures, including comparing raw data to the original source, verifying calculations, and confirming data summaries. Data distribution will not occur until data review has been completed.

Work products will be checked before final use. This includes checking calculations, reports, plans, etc. with various levels of review. The Project Manager will be responsible for the review of work as an element of his project responsibilities. The Principal-In-Charge is responsible for the overall quality of the work. One or more discipline-specific Technical Directors may be assigned by the Project Manager. Further, assignments may be made outside the project team, as needed, for quality control purposes; for example, utilizing personnel experienced in the monitoring and evaluation of natural attenuation data.

14.2 Laboratory Data Package Deliverables

CLP package deliverables will be required for this project. The laboratory will provide at least two hard-copies of each laboratory data report, an original and a copy for data validation, to the Project Manager. Electronic deliverables will also be required for the project database. Laboratory deliverables use require within 25 days of receiving samples.

14.2.1 Hardcopy Data Package

The laboratory data reports will include a full data package so that a thorough review of all QA/QC can be performed and any matrix or method issues be discovered and resolved. The data package shall consist of the following, at a minimum:

1. Detailed Case Narrative

- Date of issuance
- Laboratory analysis performed, modifications to the methods and impact on the data.
- Any deviations from intended analytical strategy

- Laboratory batch number
- Numbers of samples and respective matrices
- QC procedures utilized and also references to the acceptance criteria
- Laboratory report contents
- Project name and number
- Condition of samples 'as-received'
- Discussion of whether or not sample holding times were met and if holding times were not met a demonstration of the validity of the data.
- Discussion of technical problems or other observations which may have created analytical difficulties
- Discussion of any laboratory QC checks which failed to meet project criteria and the effect on the data.
- Signature of the Laboratory QA Officer and/or Laboratory Director or designee.
- Description of laboratory data qualifiers used
- Definitions of acronyms and qualifiers.

2. Chemistry Data Package

- Report of analysis with units clearly labeled with supporting raw data and expressed to the appropriate number of significant figures.
- Results of method blanks with supporting raw data
- Summary table showing relationship field samples to QC samples
- Surrogate recovery summaries
- Laboratory control sample summary with supporting raw data
- Matrix spike summary with supporting raw data
- Laboratory duplicate summary with supporting raw data (where applicable)
- Matrix spike duplicate summary with supporting raw data (where applicable)
- Tune Summary (GC/MS)
- Initial calibration summary and supporting raw data
- Continuing calibration summary and supporting raw data
- Internal standard summary
- Instrument sensitivity check (CRI or equivalent)
- Interference Check Sample summary
- Run logs
- Sample preparation logs
- Laboratory method detection limits
- ICP linear ranges
- Laboratory acceptance limits for QC samples
- Internal and external chains of custody
- Sample raw data

14.3 Data Tracking, Storage, and Control

The final project files will be maintained by the Project Manager in a secured, limited access area. The content of the project file will include, at a minimum, all relevant records, reports, correspondence, logs, field logbooks, laboratory sample preparation and analysis raw data,

original laboratory data packages, pictures, subcontractor's reports including data validation reports, assessment reports, progress reports, and COC records/forms.

15.0 Assessments and Response Actions

15.1 Planned Assessments

An internal audit of field activities including sampling and field observations will be conducted by the Task Manager early in the project to verify that all established procedures are being followed.

15.1.1 Data Package Technical Systems Audit

Assessment of the analytical information will be accomplished by the joint efforts of the QA Officer and Project Manager. The data assessment by the Project Manager will be based on the criteria that the samples were properly collected and handled according to the Sampling and Analysis Plan and Section 9 of this QAPP.

The QA/QC Director will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate, and blank results provided by the laboratory. An evaluation of data accuracy, precision, sensitivity, and completeness, based on criteria set forth in Section 7.0 of this QAPP, will be performed and included in the sampling event report.

The Data Review will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

15.2 Assessment Findings and Corrective Action Responses

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of QC performance which can affect data quality and usability. Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems (e.g., non-compliance with USEPA methods or QC defined in this QAPP) a formal corrective action will be implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project QA Officer. A description of the problem and the corrective action implemented will be confirmed in writing via email, facsimile, or technical memorandum.

Any nonconformances with the established QC procedures in this QAPP will be identified and corrected on an ongoing basis throughout the course of the project.

The need for corrective action may be identified at anytime during the analytical process. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the required QA objectives. If the data validator or data assessor identifies a corrective action situation, the

Project Manager will be responsible for informing the appropriate personnel. All corrective actions of this type will be documented by the Project Manager.

15.3 Additional QAPP Non-Conformances

The purpose of this section is to indicate the methods by which it will be ensured that the data collected for this investigation falls in line with the DQOs as described in Section 6 of this QAPP. To meet these DQOs, a combination of statistical procedures and qualitative evaluations will be used to check the quality of the data. These procedures will be used by the laboratory while generating the data.

Results for QC samples, including field and laboratory blanks, spikes, and duplicates as previously described in Sections 6 and 13 of this QAPP, will be evaluated using the equations in the validation guidelines to determine the validity and usability of the data. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, contamination during sampling, contamination in the laboratory, and sample preservation and storage anomalies (i.e. sample holding time or analytical instrument problems).

15.3.1 Field Sampling

Technical staff and field project personnel will be responsible for reporting all suspected technical or QA nonconformance or suspected deficiencies of any field collection or observation activity by reporting the situation to the Project Manager or designee. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the field personnel.

The Project Officer will be responsible for ensuring that corrective action for nonconformance are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and
- ensuring nonconformance reports are included in the final site documentation in project files.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action,
- The action taken in response,
- The final resolution, and
- Any necessary approvals.

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The Project QA Officer will identify deficiencies and recommend corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field Team Leader (FTL) and field team.

If appropriate, the Project Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

If a corrective action warrants a change in the program protocols, this change will be documented and signed by the FTL and the Project Manager.

15.3.2 Laboratory Analysis

The laboratories participating in this program are required to have a written policy specifying corrective actions to be taken when an analytical error is discovered or the analytical system is determined to be out of control. These policies require documentation of the corrective action and notification by the analyst about the errors and corrective procedures. Corrective action for each laboratory is described in the laboratory Quality Manual.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is dependent on the analysis and the event. Laboratory corrective actions may be necessary if:

- QC data are outside the acceptable windows for precision and accuracy
- Blanks contain compounds of interest, as listed in tables in Section 6 of this QAPP, above acceptable levels
- Undesirable trends are detected in matrix spike recoveries or RPD between duplicates
- There are unusual changes in detection limits
- Deficiencies are detected by the Laboratory QA Department during internal or external audits or from the results of performance evaluation samples
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

Corrective action may include:

- Re-analyzing the samples, if holding time criteria permits;

- Re-sampling and analyzing;
- Evaluating and amending analytical procedures;
- Accepting data and acknowledging the level of uncertainty as documented in the laboratory data package case narrative.

If re-sampling is deemed necessary due to laboratory problems, the Project Manager will identify the necessary approach including cost recovery for the additional sampling effort.

16.0 QA Management Reports

The final report will contain QA sections in which data quality information collected during the project is summarized. The QA section of the report will contain information generated during the project on the achievement of project-specific DQOs, uncertainties in the data used and their effect on the data usage, and a summary of corrective actions implemented, as necessary, as it may have affected results.

17.0 Verification and Validation Requirements

A validation of the collected data will be conducted that includes a check of the field sample and COC records and a qualitative evaluation of the laboratory data. The laboratory data evaluation will address the use of appropriate analytical methods and analytical detection limits, positive detections in blanks, comparison of data to anticipated results, evaluation of qualified data, comparison to required holding times, and a comparison to respective duplicate samples.

18.0 Verification and Validation Procedures

18.1 Data Validation

18.1.1 Procedures Used to Validate Field Data

The procedures to evaluate field information include checking for transcription errors, ensuring that field measurement equipment was properly calibrated, and review of field logbooks. Historical data from previous site assessments will be compared to the data generated during this assessment. These reviews will be performed by the Field Team Leader.

18.1.2 Procedures Used to Validate Laboratory Data

The data will be assessed for usability, completeness, and adherence to key QA/QC objectives for this project. This data assessment review will include a review of all technical holding times, instrument performance check sample results, initial and continuing calibration results, and all batch and matrix QC including field blanks, field duplicates, MS/MSD, matrix duplicates, surrogate recoveries, method blanks, LCS results, SRM results, and the identification and quantitation of specific compounds of interest.

Additionally, MDL studies for all chemicals of concern in the matrices of interest will be performed by the analytical laboratory. These MDLs must support the project reporting limit requirements and have been performed within one year of the analysis of samples collected for the screening survey. The laboratory shall follow the MDL procedures as outlined in the Federal Register, Vol. 49, No. 209, October 26, 1984, pp.198-199 and associated laboratory QAPP SOPs.

18.2 Overall Assessment of Environmental Data

Data assessment will involve data evaluation and usability to determine if the data collected are of the appropriate quality, quantity and representativeness to support the screening survey. The affect of the loss of data deemed unacceptable for use, for whatever reason, will be discussed and decisions made on corrective action for potential data gaps. The QC results associated with each analytical parameter for each matrix type will be compared to the objectives presented in Sections 6 and 13 of this QAPP. Only data generated in association with QC results meeting these objectives and the data validation criteria will be considered usable.

Factors to be considered in the overall data assessment based on the DQOs in this QAPP and the data evaluation by the Data Validator will include, but not necessarily be limited to, the following:

- Were all samples obtained using the methodologies and SOPs proposed in the QAPP?
- Were all proposed analyses performed according to the SOPs provided in the QAPP?
- Were samples obtained from all proposed sampling locations planned?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?

- Were all laboratory data evaluated according to the validation protocols, including project-specific QC objectives as defined in this QAPP?
- Which data sets were found to be unusable (qualified as "R") based on the data evaluation results?
- Which data sets were found to be usable as estimated data, (qualified as "J" or "UJ") based on the data evaluation results?
- Have sufficient data of appropriate quality been generated to support the project?
- Were all issues requiring corrective action, if any, fully resolved?
- Have any remaining data gaps been identified and summarized in the final report?

19.0 Data Usability/Reconciliation with Project Quality Objectives

The goal of this project is to produce data that can be used to further delineate groundwater contamination and to monitor the effects of the Equalization Lagoon Closure on groundwater. As such, the data generated must meet the data user's needs as defined in the project DQOs in Section 6 of this QAPP. In summary from Section 6, the primary objectives for assessing the usability of the data are (1) to collect data that are representative of site conditions that can be combined with prior data; (2) to produce data that meet the project reporting limit requirements.

The Data Validator will apply the standard data validation qualifiers to data to indicate the level of uncertainty in the associated result. In general, for the purposes of the screening survey, data that are left unqualified, data qualified "U" (non-detected), data qualified "J" (detected as an estimated result), and data qualified "UJ" (non-detected at an estimated detection reporting limit) are considered valid and usable for project objectives. Data that are qualified "R" (rejected), due to severe exceedances of QC requirements, will be considered invalid and unusable.

The goal of this program is to generate valid, usable data. However, in environmental sampling and analysis, some data may be lost due to sampling location logistics, field or laboratory errors, or matrix effects that may cause the rejection of results for some compounds. The overall goal for completeness of collection of valid data is 90%. The Data Validator will assess the completeness of the overall data generation against the project goal of producing 90% of the planned data as valid and usable results. If this goal is not met, data gaps may exist that may compromise the intended use of the data.

20.0 Special Training Requirements/Certifications

The field sampling, field analysis, laboratory analyses, and data validation tasks are considered routine tasks and will be performed by a qualified environmental professional. Therefore, these tasks will not require any additional specialized site-specific training.

The Project Health and Safety Plan requires that personnel working on project related field tasks be trained in accordance with the Occupational Safety and Health (OSHA) regulations. Prior to working on-site all potential site personnel will be required to submit certificates of OSHA training to the project manager.

APPENDIX A

FIELD PARAMETER OPERATION MANUALS

CARBON DIOXIDE TEST KIT

Model CA-23

Cat. No. 1436-01

The HACH logo is an oval containing the word "HACH" in a bold, sans-serif font. It is centered on a horizontal band that consists of two thick black lines with a white space in the middle.

HACH

Low Range

1. Fill the mixing bottle to the 23-mL mark with the water sample.
2. Add one drop of Phenolphthalein Indicator Solution to the sample.
3. Add the Sodium Hydroxide Solution drop by drop to the sample. Count each drop as it is added. Swirl the bottle to mix after each drop is added as shown in Figure 1. Continue adding drops until a light pink color forms and persists for 30 seconds.
4. Each drop of Sodium Hydroxide Solution used equals 1.25 mg/L carbon dioxide (CO₂).

WARNING: *The chemicals in this kit may be hazardous to the health and safety of the user if inappropriately handled. Please read all warnings before performing the test and use appropriate safety equipment.*

HACH COMPANY, P.O. BOX 389, LOVELAND, COLORADO 80359
TELEPHONE: WITHIN U.S. 800-227-4224, OUTSIDE U.S. 970-669-3050, TELEX: 160840

ium Range

Fill the mixing bottle to the 15 mL mark with the water sample.

Add one drop of Phenolphthalein Indicator Solution to the sample.

Add the Sodium Hydroxide Solution drop by drop. Count each drop as it is added. Swirl the bottle to mix after each drop is added. Continue adding drops until a light pink color forms and persists for 30 seconds.

Each drop of Sodium Hydroxide Solution used equals 2 mg/L carbon dioxide (CO₂).

h Range

Fill the plastic measuring tube level full with the water to be tested. Transfer to the mixing bottle by placing the mixing bottle over the tube and then turning the bottle right-side up.

Add one drop of Phenolphthalein Indicator Solution to the contents of the mixing bottle.

Add the Sodium Hydroxide Solution drop by drop. Count each drop as it is added. Swirl the bottle to mix after each drop is added. Continue adding drops until a light pink color forms and persists for 30 seconds.

Each drop of Sodium Hydroxide Solution used equals 5 mg/L carbon dioxide (CO₂).

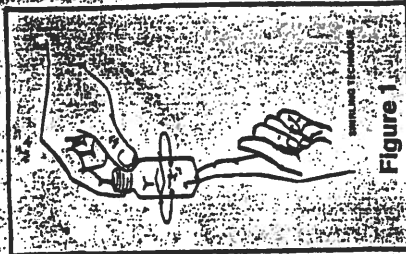


Figure 1

REPLACEMENTS

Cat. No.	Description	Unit
1897-36	Phenolphthalein Indicator Solution, 1 g/L	15 mL (½ oz) SCDB
671-37	Sodium Hydroxide Solution, 0.01N	118 mL (4 oz) MDB
438-00	Measuring Tube	each
2327-06	Mixing Bottle	pkg/6

*Self-contained Dropping Bottle

†Marked Dropping Bottle

Hach Company, 1982, 1984, 1985. All rights are reserved.

MANGANESE TEST KIT

0-3 mg/L
Model MN-5
Cat. No. 1467-00

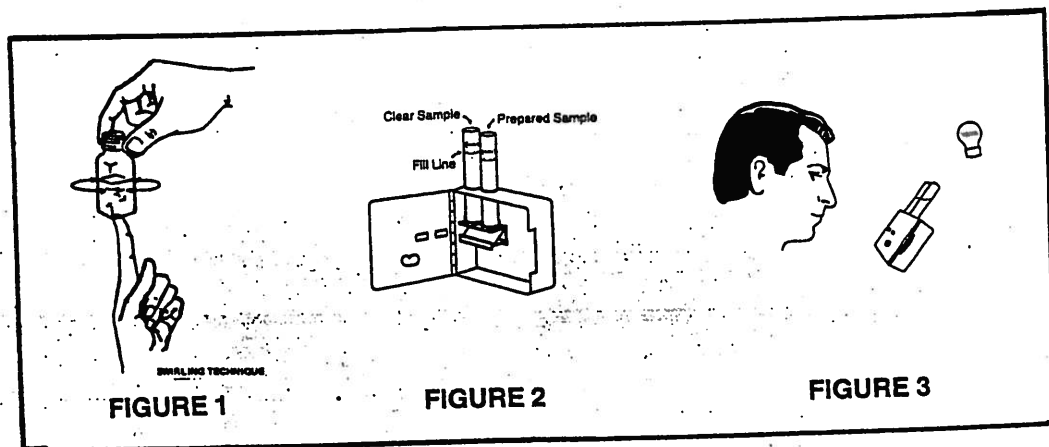
The HACH logo is centered within a thick horizontal black bar. The logo itself consists of the word "HACH" in a bold, sans-serif font, enclosed within an oval border.

1. Fill a sample mixing bottle to the shoulder with the water to be tested.
2. Use the clippers to open one Buffer Powder Pillow for Manganese, Periodate Method. Add the contents of the pillow to the mixing bottle. Swirl to mix as shown in Figure 1.
3. Use the clippers to open one Sodium Periodate Powder Pillow. Add the contents of the pillow to the mixing bottle and swirl to mix.
4. A pink color will develop if manganese is present.
5. Allow the prepared sample to stand undisturbed for one minute to allow full color development.
6. Fill one sample tube to the line underlining "Cat. 1730-00" with the prepared sample. This will be approximately 15 mL. If not using 1730-00 tubes, fill to the line found at approximately 3 inches up from the bottom of the tube.

WARNING: The chemicals in this kit may be hazardous to the health and safety of the user if inappropriately handled. Please read all warnings before performing the test and use appropriate safety equipment.

HACH COMPANY, P.O. BOX 389, LOVELAND, COLORADO 80359
TELEPHONE: WITHIN U.S. 800-227-4224, OUTSIDE U.S. 970-669-3050, TELEX: 160840

7. Place the lengthwise viewing adapter into the comparator as shown in Figure 2.
8. Insert the tube of prepared water sample into the comparator opening labeled Prepared Sample Position in Figure 2.
9. Fill the other sample tube with untreated water or a reagent blank to the line underlining "Cat. 1730-00". Insert this tube into the comparator opening labeled Clear Sample Position in Figure 2.
10. Hold the comparator with the tube tops pointing to a window or light source as in Figure 3. View through the openings in the front of the comparator. When viewing, use care to not spill samples from unstoppered tubes.
11. Rotate the disc to obtain a color match. Read the mg/L manganese (Mn) through the scale window.



REPLACEMENTS

Cat. No.	Description	Unit
983-66	Buffer Powder Pillows for Manganese, Periodate Method	pk/50
984-99	Sodium Periodate Powder Pillows	pk/100
439-06	Bottle, mixing	pk/6
968-00	Clippers	each
1732-00	Color Comparator	each
1730-00	Color Disc (Manganese)	each
1929-00	Color Viewing Tube	each
24122-00	Lengthwise Viewing Adapter	each
14480-00	Stopper	pk/6

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MADE IN U.S.A.

1/90

Oxygen CHEMets®

0 - 1 ppm

Sampling

The most critical part of any dissolved oxygen test is sampling. The sample stream must be completely leak-free. The sampling tube is vertically mounted with a tube of inert material connecting the sample point to the bottom of the sampling tube. Use stainless steel, type 304 or 316, or glass tubing with short neoprene connections. Do not use copper tubing, long sections of neoprene or other polymeric tubing. If a flowing sample is not available, the sample must be handled with as little agitation as possible. A sub-surface sampler/snapper is available to minimize sample contamination (see Reorder Information).

Test Procedure

1. To remove trapped air bubbles, the system should be purged with water that is flowing at the fastest possible rate, and has a temperature of 180 - 210°F (80 - 100°C). New sampling systems should be purged for several hours, while those used routinely may require only a few minutes. When the system is fully purged, reduce the flow to 500 - 1000 mL per minute and cool the sample to ambient temperature.
2. Insert a CHEMet ampoule so that the tapered tip is at the bottom of the sampling tube. Snap the ampoule tip by gently pressing the upper end of the ampoule toward the wall of the sampling tube (fig. 1). The ampoule will fill, leaving a bubble to facilitate mixing.
3. Quickly mix the contents by inverting the ampoule, allowing the bubble to travel from end to end. Wipe all liquid from the exterior of the ampoule. The color comparison must be made within 30 seconds.

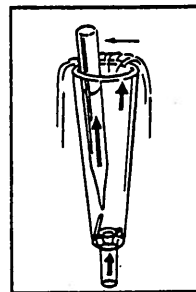


Figure 1

4. Hold the comparator in a nearly horizontal position while standing directly beneath a bright source of light. Place the CHEMet ampoule between the color standards moving it from left to right along the comparator until the best color match is found (fig 3). If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

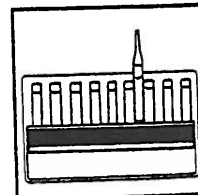


Figure 2

Test Method

The Oxygen CHEMets^{®1} test employs the Rhodazine DTM Method.^{2,3} Dissolved oxygen reacts with the pale yellow colored leuco form of Rhodazine D to produce a deep rose color. The resulting color is proportional to the dissolved oxygen concentration in the sample. Results are expressed in ppm (mg/Liter) O₂.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038

2. Rhodazine D methodology was developed by and is a trademark of CHEMetrics, Inc.

3. ASTM D 5543 - 94, Standard Test Methods for Low Level Dissolved Oxygen in Water

Safety Information

Read MSDS before performing this test procedure. Wear safety glasses.

Important Note

The CHEMet ampoules contain a reagent which will deteriorate upon prolonged exposure to light. They will remain stable only if stored in the dark.

Reorder Information

Cat. No.

Test Kit, complete	K-7501
Refill, 30 CHEMet ampoules	R-7501
Comparator, 0-1 ppm	C-7501
Sampling Tube, package of six	A-0020
Sub-surface Sampler/Snapper	A-0139
Mounting Clamp Adhesive, package of six	A-0022
Mounting Clamp Permanent, package of six	A-0034

Rt. 28, Calverton, VA 20138-0214 U.S.A.

Phone: (800) 356-3072; Fax: (540) 788-4856; E-Mail: prodinfo@chemetrics.com

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24 Hour Emergency Numbers: (703) 590-9204
(540) 439-3860
Creation Date: 04/22/86 (1072-8)
Revision Date: 12/07/98

MATERIAL SAFETY DATA SHEET

I. TRADE NAMES: DISSOLVED OXYGEN CHEMetrics®, ULR CHEMetrics® and Vacu-Vials®

CATALOG NOS.: R-7501, R-7501U, R-7501V, R-7511, R-7518, R-7518U, R-7540, R-7540G, R-7540N, R-7540U, R-7540V, R-7553, K-7580U, K-7599 and K-7599V

DESCRIPTION: Reagent ampoules for the determination of dissolved oxygen in water. Each CHEMet™ contains approximately 0.50 mL of liquid reagent sealed under vacuum. Each ULR CHEMet™ contains approximately 1 mL of liquid reagent sealed under vacuum. Each Vacu-vial™ contains approximately 2 mL of liquid reagent sealed under vacuum.

NFPA RATINGS: HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0

II. COMPONENTS

COMPONENT: Diethylene Glycol
CAS NO.: 111-46-6 PERCENT: 25.0

COMPONENT: Deionized Water
CAS NO.: 7732-18-5 PERCENT: >74.0

COMPONENT: Other components
CAS NO.: N/A PERCENT: < 1.0

Any component of this mixture not specifically listed (e.g. "other components") is not considered to present a carcinogen hazard.

III. PHYSICAL DATA

STATE: Liquid APPEARANCE: Colorless to pale yellow ODOR: None
SOLUBILITY IN WATER: Miscible pH: 11.5
BOILING POINT: 150°C MELTING POINT: -5.0°C
VAPOR PRESSURE: N/A SPECIFIC GRAVITY (H₂O = 1): 1.03
VAPOR DENSITY (AIR = 1): N/A

IV. FIRE AND EXPLOSION DATA

FLASH POINT: N/A AUTOIGNITION POINT: N/A
FLAMMABILITY LIMITS: UPPER: N/A LOWER: N/A
EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, water spray or foam

V. REACTIVITY DATA

HAZARDOUS DECOMPOSITION PRODUCTS: None

VI. HEALTH HAZARD DATA

OSHA & ACGIH THRESHOLD LIMIT VALUE: None established
ACUTE TOXICITY: Irritation
CHRONIC TOXICITY: Irritation
CARCINOGEN STATUS: None
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: May cause irritation to eyes, skin and mucous membranes.

VII. FIRST AID

EYE AND SKIN CONTACT: Immediately flush eyes and skin with water for 15 minutes.

INGESTION: Seek medical attention.

INHALATION: Remove individual to fresh air.

VIII. PRECAUTIONS

If this product is used as directed, the user will not come in contact with or be exposed to any of its chemical components.
Wash thoroughly after handling.
Avoid contact with eyes.
FRAGILE: Liquid in glass. Handle with care.
PROTECTIVE EQUIPMENT: Safety glasses

IX. SPILL AND DISPOSAL PROCEDURES

Take up with absorbent material. Place in small containers for disposal. Dispose of in accordance with all Federal, State and Local Regulations.

X. STORAGE CONDITIONS

Product should be stored in the dark and at room temperature; however, temperatures up to 120°F or even below freezing will not normally affect reagent performance.

THE ABOVE INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. ALL PRODUCTS ARE OFFERED IN ACCORDANCE WITH THE MANUFACTURER'S CURRENT PRODUCTION SPECIFICATIONS AND ARE INTENDED SOLELY FOR USE IN ANALYTICAL TESTING. THE MANUFACTURER SHALL IN NO EVENT BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE RESULTING FROM THE HANDLING, USE OR MISUSE OF THESE PRODUCTS.

CHEMetrics®, ULR CHEMetrics® and Vacu-vials® are registered trademarks of CHEMetrics, Inc.

Oxygen CHEMets®

1 - 12 ppm

Sampling

The most critical part of any dissolved oxygen test is sampling. It is difficult to obtain an aliquot which accurately reflects the oxygen content of a sample. Exposure to the high oxygen content of "air" will cause a sample to approach saturation. Biological activity may cause rapid oxygen depletion. Dipping and pouring operations should be performed with as little agitation as possible. A two foot sub-surface sampler/snapper is available to minimize sample contamination (see Reorder Information).

Test Procedure

1. Fill the sample cup to the 25 mL mark with your sample (fig. 1).
2. Place the CHEMet ampoule in the sample cup. Snap the tip by pressing the ampoule against the side of the cup. The ampoule will fill, leaving a small bubble to facilitate mixing (fig. 2).
3. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time. Wipe all liquid from the exterior of the ampoule. Wait 2 minutes for color development.
4. Hold the comparator in a nearly horizontal position while standing directly beneath a bright source of light. Place the CHEMet ampoule between the color standards moving it from left to right along the comparator until the best color match is found (fig 3). If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

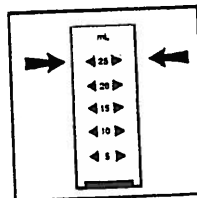


Figure 1

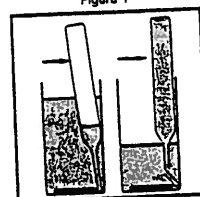


Figure 2

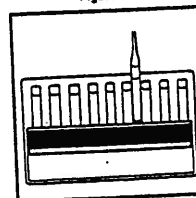


Figure 3

Test Method

The Dissolved Oxygen CHEMets®¹ test employs the indigo carmine method^{2,3}. In an acidic solution, oxygen oxidizes the yellow-green colored leuco form of indigo carmine to form a highly colored blue dye. The resulting blue color is proportional to the dissolved oxygen concentration in the sample. Test results are expressed in ppm (mg/Liter) dissolved oxygen as O₂.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. ASTM D 888 - 87. Dissolved Oxygen in Water, Test Method A—Colorimetric Indigo Carmine
3. Gilbert, T. W., Behymer, T. D., Castaneda, H. B., "Determination of Dissolved Oxygen in Natural and Wastewaters," *American Laboratory*, March 1982, pp. 119-134

Safety Information

Read MSDS before performing this test procedure. Wear safety glasses.

Important Note

The CHEMet ampoules contain a reagent which will deteriorate upon prolonged exposure to light. They will remain stable only if stored in the dark.

Reorder Information

Cat. No.

<i>Test Kit, complete</i>	<i>K-7512</i>
<i>Refill, 30 CHEMet ampoules</i>	<i>R-7512</i>
<i>Sample Cup, 25 mL, package of six</i>	<i>A-0013</i>
<i>Comparator, 1-12 ppm</i>	<i>C-7512</i>
<i>Sub-surface Sampler/Snapper,</i>	<i>A-0139</i>

Kits are available for dissolved oxygen analysis at other levels.



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E-Mail: prodinfo@chemetrics.com
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